MOSS FLORA

OF

NORTH AMERICA

North of Mexico

BY

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ANDREAEACEAE

BY

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ARCHIDIACEAE

BY

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Order ANDREAEALES.*

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Plants relatively small, dark, growing in tufts or cushions on non-calcareous rocks of mountainous or frigid regions. Stems slender, radiculose only at the base, dichotomous, or with fasciculate branches. Central strand none; stem composed of stereid-cells with uniformly and densely thickened cell-walls. Leaves relatively small, frequently crowded, papillose or smooth, costate or ecostate, ovate to subulate, olive- to reddish-brown. Leaf cells small, obscure, incrassate, rectangular and sometimes sinuose at base, angular or rounded above.

Monoicous or dioicous; antheridia usually in gemmiform buds, on separate branches. Perichaetial leaves larger, erect, convolute, or scarcely differentiated from the stem-leaves. Sporophyte dark, small, without a seta but shortly exserted at maturity on a pseudopodium. Capsule ovate-oblong, without intercellular air spaces, opening at maturity usually by means of 4 (sometimes as many as 10) longitudinal slits which do not converge at apex and are closed when moist and widely gaping when dry. Columella thick, persistent. Spores 15–40 μ, smooth or slightly roughened, dark, thick-walled. Calyptra campanulate, mitriform, fugacious, lacerate at the base.

Protonema normally thallose, starting its development inside the spore.

The order is represented by one family, *Andreaeaceae*, and in North America by one genus, *Andreaea*

ANDREAEA Hedw. Spec. Musc. 47. 1801.

The genus has characters as stated for the order.

KEY.

1.	Leaves ecostate	2.
	Leaves costate	3.
2.	Leaves distinctly panduriform	*2. obovata.*
	Leaves not panduriform	*1. rupestris.*
3.	Perichaetial leaves similar to stem leaves; upper margin serrate and papillose	*5. nivalis.*
	Perichaetial leaves much larger and more convolute than stem leaves; upper margin usually neither distinctly serrate nor papillose	4.
4.	Costa flat and often weak at the base of the leaf	*3. Blyttii.*
	Costa thick and strong at the base of the leaf	*4. Rothii.*

1. ANDREAEA RUPESTRIS Hedw. Sp. Musc. 47. *pl. 7. fig. 2*, exclud. syn. 1801.

Andreaea petrophila Ehrh. Beitr. **1**: 192. 1787.

Plants crowded in dark-green, reddish-brown or black cushions; stems 1–3 cm. long (occasionally longer), rigid when dry, simple or dichotomous; leaves crowded, *ecostate*, extremely variable in shape, direction and texture, usually asymmetric, *not panduriform*, concave, ovate to almost lanceolate, muticous or slightly apiculate, nearly smooth to strongly papillose on the back, when moist spreading from an erect base, *laxly appressed when dry*, 0.7–1.5 mm. long, 0.2–0.7 mm. wide; margin entire and incurved; apex often hyaline and crenulate; basal cells oblong with linear often irregular lumen, smooth; median cells shorter; cells of the upper third of the leaf punctiform; perichaetial leaves larger, softer, erect and convolute, often more blunt and paler, inner smooth, outer papillose, 1–3 mm. long. Monoicous; pseudopodium immersed

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or slightly exserted; capsule small, pale below, reddish-brown above; spores brown, 20–30 μ, ovoid, often slightly roughened, maturing in summer.

Type locality, Europe.

ILLUSTRATIONS:—Hedw. Sp. Musc. l. c.; Bry. Eur. *pl. 623–626;* Braithw., Brit. Moss Flora **1:** *pl 1A;* Dixon & Jameson, Hdbk. Brit. Mosses, (Ed. 3) *pl. 4A;* M. H. M. *pl. 6.*

EXSICCATI:—Drummond, Musci Am. 1; Sull. Musci Allegh. 215. Sull. & Lesq. Musci Bor. Am. 18, (Ed. 2) 24; Aust. Musci Appal. 42; Holz. Musci Acro. Bor. Am. 226; R. & C. Musci Am. Sept. 201; Grout, N. Am. Musci Perf. 183.

Common on moist non-calcareous rocks in mountainous or colder regions. Alaska to Greenland, south along the mountains, in the east to Georgia, in the west to California and Colorado; Newfoundland.

This is a most variable species, a fact which accounts for the large number of untenable species which have been described from material here included in this species and its varieties.

Var. ALPESTRIS Thed. Nya. Bot. Not. **1849:** 79. *fig. 45–47.* 1849.

Andreaea alpestris (Thed.) Bry. Eur. (fasc. 62–64) Andr. 16. *pl. 626.* 1855.
Andreaea parvifolia C. Müll. Flora **70:** 219. 1887.

This variety differs from *A. rupestris* in the *crowded, smaller leaves which are closely appressed when dry.* The cells are generally broader, the walls less pitted and not so papillose.

Type locality: Switzerland.

ILLUSTRATIONS:—Thed. l. c.; Bry. Eur. *pl. 626;* Braithw. Brit. Moss Flora **1:** *pl. 1C.*
EXSICCATI:—Holz. Musci Acro. Bor. Am. 276.
On non-calcareous rocks. Greenland south to New York; Alaska south to Montana and Washington.

Var. ACUMINATA Bry. Eur. (fasc. 62–64) Andr. 13. *pl. 624.* 1855.

Andreaea sublaevis Kindb. Eur. & N. Am. Bryin. 393. 1897.
Andreaea papillosa Lindb. Oefv. Sv. Vet.-Akad. Forh. **23:** 557. 1867.

This variety differs from the species in that it is *usually larger, with longer,* acuminate leaves and *usually larger papillae.*

Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. l. c.; Braithw. Brit. Moss Flora **1:** *pl. 1A γ; Pl. 1A.*
EXSICCATI:—Williams, Plants of Yukon Terr. 523.
Rare; on non-calcareous rocks. Greenland, Yukon Territory.
The type of *A. papillosa* has not been seen, but there is nothing in the description to distinguish it from the variety *acuminata.*
Kindberg's *A. sublaevis* is much like *acuminata* but is not so papillose. Williams' plants are not as papillose as the above description indicates.

Var. SPARSIFOLIA (Zett.) Lindb. Spitz. Moss. 559. 1867.

Andreaea sparsifolia Zett. Monogr. Andr. 32. 1855.

Plants in small open tufts; stems very slender with few branches; *leaves small, distant, spreading, gradually acuminate,* with small papillae.

Type locality, Scandinavia.

ILLUSTRATIONS:—Limpricht, Laubm. **1:** *fig. 53;* Braithw. Brit. Moss Flora **1:** *pl. 1.*
A single collection by Waghorne in Newfoundland seems referable to this variety.

2. ANDREAEA OBOVATA Thed. Bot. Notiser **1849:** 78. *fig. 27–36.* 1849.

Similar to *A. rupestris,* but with *symmetric, broadly ovate, panduriform leaves (clasping at the base), which are either mammillose or papillose at back with low brown papillae.*

Type locality, Sneehätten, Dovrefjeld, Norway.

ILLUSTRATIONS:—Thed. l. c.; Bry. Eur. *pl. 627; Pl. 2B.*
EXSICCATI:—Berggren, Plantae in itineribus Suecorum polaribus collectae. Ritenbank. 1870.
On rocks. Greenland.

It is obvious that *A. obovata* is related to *A. rupestris*, but the broad, symmetric, panduriform leaves serve to distinguish the former from the latter.

3. ANDREAEA BLYTTII Bry. Eur. (fasc. 62–64) Andr. 25. *pl. 635*. 1855.

Andreaea perichaetialis Zett. Monogr. Andr. 26. 1855.

Plants brown or black in low colonies; stems 1–2 cm. high, rigid and brittle; branches slender, subapical; leaves spreading, often slightly secund at the apex, lanceolate to lanceolate-subulate, 1–2 mm. long, with a short oblong base which rapidly narrows into a subula above; *costa flat and weak below, stronger above but not conspicuous;* basal cells oblong, not sinuose or porose; those above, round or square, distinct, with thick walls, often mammillose but *never strongly papillose;* perichaetial leaves larger, 1–2.5 mm., concave, convolute, the inner ones ecostate. *Dioicous;* the male plants more slender; *sporophyte small;* capsule dark, 0.75 mm. in diameter, ovate-conic, apiculate; spores small, 11–14 μ, brown, smooth, maturing in summer.

ILLUSTRATIONS:—Bry. Eur. l. c.; *Pl. 1B*.
On rocks. Greenland, Davis Straits, Arctic America, Washington (Olympic Mts.), California.
In the herbarium of the New York Botanical Garden, there is a collection from California by Bolander which is certainly referable to this species. Its distribution is noteworthy as it has been collected but once between Alaska and California!
There is no need to confuse this plant with *A. Rothii* var. *crassinervia* since the latter exhibits a costa which is distinct and thickened to the base of the leaf.

Var. OBTUSIFOLIA (Berggr.) Sharp, **comb. nov.**

Andreaea obtusifolia Berggr.; G. Roth, Aussereur. Laubm. **1**: 72. *pl. 7. f. 6a.* 1910. Not *A. obtusifolia* T. Jens.

This variety differs from *A. Blyttii* in the *broader, more obtuse leaves*, and in exhibiting a *costa which is often lacking in the base of the leaf and weak above.*

ILLUSTRATIONS:—G. Roth, l. c.
Rare; on rocks. Greenland.

4. ANDREAEA ROTHII Web. & Mohr. Bot. Tasch. 386. *pl. 11. fig. 7–9*. 1807.

Andreaea rupestris Roth, Neue Beytr. **1**: 234. 1802, exclud. syn.
Andreaea rupestris Turn. Musc. Hibern. 14. 1804.

Plants small, black, occasionally brown; stems dichotomous or fastigiate, 1–2.5 cm. long, often denuded at the base; leaves slender, 0.8–1 mm. long, spreading or secund, often falcate, from an ovate or oblong base gradually or suddenly contracted into a long, lanceolate-acuminate point; margin entire or crenate; *costa strong, prominent* and often rough at back, subpercurrent or percurrent; basal cells near the margin quadrate, near the middle linear-oblong *with small irregular lumen;* upper cells small, punctiform, their walls thick and often mammillose; perichaetial leaves larger, oblong with an acuminate point, 1.5–2 mm. long, the outer costate and occasionally papillose above, the inner ecostate. Monoicous; capsule oblong-ovate, dark, pale at base, 0.75 mm. long; spores large, 30–40 μ, very slightly roughened, maturing in summer.
Type locality, Mt. Snowden, Wales.

ILLUSTRATIONS:—Web. & Mohr., l. c.; Bry. Eur. *pl. 631;* Braithw. Brit. Moss Flora **1**: *pl. 2A;* Limpricht, Laubm. **1**: *fig. 56;* Dixon & Jameson, Hdbk. Brit. Mosses (Ed. 3) *pl. 4C;* M. H. M. *fig. 11*.
EXSICCATI:—Sull. Musci Allegh. 214; Sull. & Lesq. Musci Bor. Am. 19, (Ed. 2) 25; Aust. Musci Appal. 43; Holz. Musci Acro. Bor. Am. 302; Grout, N. A. Musci Perf. 294 (as *A. rupestris* Hedw.).
On non-calcareous rocks. Greenland and Newfoundland to the Upper Peninsula of Michigan and south along the mountains to Georgia and Alabama; rare in British Columbia and northwestern U. S.

Var. FALCATA (Bry. Eur.) Lindb. in lit., Braithw. Brit. Moss Flora **1**: 14. *pl. 2.* 1880.

Andreaea falcata Bry. Eur. Andr. 24. *pl. 624.* 1855.

Plants with *leaves falcate* and *erose-dentate near the apex.* Type locality, Europe.

ILLUSTRATIONS:—Braithw. l. c.; Bry. Eur. l. c.
EXSICCATI:—Macoun, Vancouver Island, May 19, 1893.
Extremely rare. British Columbia.

Var. CRASSINERVIA (Bruch) Mönkem. Laubm. Eur. **4**: 129. 1927.

Andreaea crassinervia Bruch, Abh. Akad. Münch. **1**: 279. *pl. 10.* 1832.

Costa *distinctly excurrent; basal cells seldom with irregular lumen;* otherwise very similar to *A. Rothii*. Type locality, Grimsel, Switzerland.

ILLUSTRATIONS:—Bruch, l. c.; Bry. Eur. *pl. 633;* Braithw. Brit. Moss Flora **1**: *pl. 1C;* Limpricht, Laubm. **1**: *fig. 54;* Dixon & Jameson, Hdbk. Brit. Mosses (Ed. 3) *pl. 4D;* M. H. M. *fig. 12.*
EXSICCATI:—Holzinger, Musci Acro. Bor. Am. 301; Small, Mosses of South. U. S. 27.
Rare; on rocks. Mountains of eastern North America; Labrador to Georgia.
Much of the material labeled *A. crassinervia* in herbaria is *A. Rothii*. Leaves with narrow laminae or with eroded margins bear the appearance of having excurrent costae, a condition which contributes to the confusion. Occasional collections are found with both subpercurrent and excurrent costae in the leaves and all intergradations between. There is no character at present discovered which will separate them in all cases.

5. ANDREAEA NIVALIS Hook. Trans. Linn. Soc. **10**: 395. *pl. 31.* 1811.

Andreaea nivalis var. *fuscescens* Hook. l. c.
Andreaea Macounii Kindb.; Macoun, Bull. Torr. Bot. Club **17**: 83. 1890.
Andreaea Baileyi Holz. Bryol. **27**: 78. 1924.

Plants the largest of the North American *Andreaeae, not harsh or brittle*, reddish-brown or darker but *not black;* stems slender, 4–10 cm. long, erect or trailing, with few dichotomous branches which are subapical, flexuose and secund at tips; leaves soft, rather distant, secund, 1–1.5 mm. long, the lower smaller, wider, the upper longer and more slender, from an oblong base gradually narrowed; costa strong, percurrent or obscure in the rough subulate tip, *dentate or papillose on the back; margins sinuose-dentate and papillose* (occasionally entire) *above, generally irregularly dentate below; cells rounded or square, similar throughout, seldom opaque, papillose on both sides; perichaetial leaves similar to those of the stem* except in size, 2–2.5 mm. long. Dioicous; sporophyte rare; capsule brown, about 1 mm. long, oblong, slightly exserted, *with 6* (rarely 4) *slits;* calyptra very small, conic; spores essentially smooth, 20–25 μ, maturing in summer.

Type locality, Ben Nevis, Scotland.

ILLUSTRATIONS:—Hook. l. c.; Bry. Eur. *pl. 636;* Braithw. Brit. Moss Flora **1**: *pl. 2B;* Dixon & Jameson, Hdbk. Brit. Mosses (Ed. 3) *pl. 4E; Pl. 2A.*
EXSICCATI:—Macoun, Can. Musci 34 & 401; Holzinger, Musci Acro. Bor. Am. 501 as *A. nivalis Baileyi.*
On moist alpine rocks near the glaciers. Washington, Oregon, British Columbia.
This, the largest of the North American *Andreaea* species, may be recognized by its size, softness, the peculiar fulvous tint, the distinctness of the uniform, unelongated cells, and the undifferentiated perichaetial leaves when they are present.
Although the species, *A. Macounii* and *A. Baileyi*, and the variety, *fuscescens*, sometimes appear distinct, more extensive collections show intergradations with *A. nivalis*. There are not enough reliable distinctions to warrant separating them.

Order BRYALES.

The mosses of this order vary much in detail. With few exceptions they spring from a filamentous protonema; the outer wall of the archegonium after some growth is ruptured, the lower portion forming the vaginula and the upper, the calyptra. The lower part of the embryo forms the seta, which may be exceedingly short or reach a length of several centimeters, the upper part becomes the capsule; the endothecium gives rise to the spore-producing tissue, which surrounds an inner sterile tissue; this becomes the columella in all the species except *Archidium*, but not apparent in the *Ephemeraceae*. The capsules may dehisce irregularly, but most open by an evenly dehiscent lid or operculum, usually separating from the rest of the capsule by the aid of a special row or rows of cells, the annulus. In the great majority of the species there is produced from the layers of cells immediately under the lid a complex structure, the peristome, which is strongly hygroscopic and whose function is to control spore distribution. The peristome is often beautifully sculptured and colored and a delight to the eye of the microscopist. Below the spore sac

many capsules have a more less apparent neck or collum in which are stomata of various degrees of perfection and considerable assimilative tissue.

Family TETRAPHIDACEAE.

Plants minute to medium sized, gregarious to cespitose; stems erect, simple or sparingly branched; leaves unistratose, ovate to lanceolate, smooth; costa present, usually well developed and ending just below the leaf apex; leaf cells parenchymatous, rounded-hexagonal to elongate, thick-walled; perichaetial leaves longer and narrower. Autoicous; inflorescence apical; seta long, straight or geniculate near the middle; capsule erect and symmetric or rarely slightly arcuate, smooth, ovoid to cylindric; calyptra mitriform, plicate; annulus lacking; operculum conic, unistratose, of epidermal cells only; peristome teeth 4, solid, derived from the splitting of the entire cell mass within the operculum, homogeneous, not segmented, open when dry, closed when wet.

A very small family of four or five species, considered primitive by reason of the peristome structure and peculiar frondiform growths from the protonema.

TETRAPHIS Hedw. Sp. Musc. 45. 1801.

Georgia Ehrh. Han. Mag. **1780.** 932. 1780.

Characters as in the family. Dixon's opinion (Handb. Brit. Mosses (Ed. 3) 30, is heartily endorsed. "Braithwaite is no doubt right in reuniting the two European species under this genus, the characters separating *Tetrodontium* being hardly of generic value.

The genus is easily recognized in the field by the 4-toothed peristome, which is usually present, as the plants fruit freely and capsules and peristome are long persistent. Type species, *T. pellucida*.

KEY.

1. Plants almost stemless; costa faint; calyptra covering the entire capsule; no gemmiferous plants ..... *3. Browniana.*
   Stems 1–3 cm. long; costa strong, ending near the apex; calyptra covering not more than ½ the capsule; gemmiferous plants usually present ..... 2.
2. Seta smooth, not noticeably geniculate ..... *1. pellucida.*
   Seta geniculate and tuberculate above the bend ..... *2. geniculata.*

1. TETRAPHIS PELLUCIDA Hedw. Sp. Musc. 45. *pl. 7, f. 1, a–f.* 1801.

Mnium pellucidum of Linnaeus and many authors before 1801.
Georgia pellucida Rabenh. Deutsch. Krypt. Fl. 2^3: 231. 1848.

Plants densely to loosely cespitose; stems erect, 1–3 cm. long, radiculose at base; lower leaves minute, the upper larger, closer at the top of the stem, ovate to ovate-lanceolate from a narrower base, mostly acute; perichaetial leaves, longer and narrower, oblong-lanceolate, up to 4 mm. long, obtuse to obtusely acute; all entire; many sterile stems bear at the summit a cup composed of short leaves, broadly obovate to reniform, truncate to apiculate; inside the cup many stalked gemmae, lenticular and many celled,mixed-with numerous paraphyses; costa strong, ending below the apex, or in perichaetial leaves sometim es per current; leaf cells rounded, nearly isodiametric, variable in outline, 8–20 μ in diameter in the upper middle leaf, smaller near the margins, elongated toward the base, especially near the costa and in the lower portion of the perichaetial leaves. Seta straight and erect, 1–1.5 cm. long, smooth; capsule narrowly cylindrical, erect and symmetric or occasionally slightly arcuate, 2–2.5 mm. long, persistent; stomata lacking; calyptra rough at the apex; operculum acutely conical; peristome teeth narrowly triangular, composed of elongated cells; spores 8–12 μ, mature in spring to early summer.

Type locality, European.

ILLUSTRATIONS:—Hedw. l. c.; Bry. Eur. *pl. 196;* Braithw. Brit. Moss. Fl. **1**: *pl. 4A;* M. H. M. *figs. 3 & 13; Pl. 3.*

EXSICCATI:—Drumm. Musc. Am. 31; Sull. Musc. Allegh. 154; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 110, (Ed. 2) 164; Aust. Musc. Appal. 173; Holz. Musc. Acro. Bor. Am. 67; Grout, Musci Perf. 56; Allen, Mosses Cascade Mts. 47.

On humus and decaying wood in cool moist, shaded places; common and widely distributed in northern N. America across the continent; south to Georgia, Tennessee, Missouri and California.

1a. Forma CUSPIDATA (Kindb.) **n. comb.**

Georgia cuspidata Kindb. Rev. Bryol. **20**: 93. 1893.

Perichaetial leaves cuspidate by the excurrent costa ("nervure longuement excurrente") Leamington, Canada, Sept. 22, 1890 (Macoun); Ohio (Schrader).

In specimens in the National Museum of Canada from the type locality and collected by Macoun on Sept. 20 instead of 22, the perichaetial leaves are very slender-pointed but the costa is barely or not at all excurrent. This variation is certainly not worthy of rank above a form.

2. TETRAPHIS GENICULATA Girgens., Milde, Bot. Zeit. **3**: 155. 1863.

Georgia geniculata Lindb. Cont. ad Fl. Asi. Bor. Or. **1872**: 239. 1872.
Georgia trachypoda Kindb. Rev. Bryol. **20**: 93. 1893.

Differs from *T. pellucida* in the longer and narrower upper leaves, more slender-pointed; perichaetial leaves acute; seta usually bent in the middle and always rough above the bend with large distant papillae or tubercles.

Type locality, Japan.

ILLUSTRATIONS:—Bry. Eur. Suppl. Tetraphis, *pl. 1; Pl. 4B.*
EXSICCATI:—Holz. Musc. Acro. Bor. Am. 343; Macoun, Can. Musci 422.
Northern N. America; south to Oregon, Idaho and Nova Scotia. Habitat similar to that of the last.

Not materially different in macroscopic appearance from *T. pellucida*, as the seta is not always noticeably bent at first glance and the bend is sometimes absent as in Kindberg's *Georgia trachypoda* (the only difference of importance that he notes in his description). The roughness of the upper seta in this species is a distinct character, but a relatively high power is needed to see it.

Specimens in the herbarium of the National Museum of Canada, labeled *Georgia trachypoda* and collected at same date and place as the type and probably a part of it, have the seta only slightly roughened and not geniculate, otherwise normal.

3. TETRAPHIS BROWNIANA (Dicks.) Grev. Flor. Edinb. 230. 1824.

Bryum Brownianum Dicks. Pl. Crypt. fasc. **4**: 7. *pl. 10.* 1801.
Tetraphis ovata Schwaegr. Suppl. **1**: 39. *pl. 13.* 1811.
Georgia Browniana C. Muell. Syn. **1**: 181. 1848.
Tetrodontium Brownianum Schwaegr. Suppl. **2**[1]: 102. *pl. 129.* 1824.

Plants very small, about the size of a *Seligeria;* stems almost wanting; radical frondiform leaves 2–3 stratose, persistent, long linear-clavate, sometimes palmately branched at the upper end; among these a perichaetial bud of 8–12 leaves is produced; of these the lower or outer are very small and ecostate, all are ovate to oblong-lanceolate, concave, obtuse to acute, entire or finely crenulate above; the upper over 1 mm. long and costate to above the middle; median leaf cells rhomboidal to rectangular, larger and laxer toward the base, shorter and more irregular near the apex. Seta 4–6 mm. long, straight and erect; calyptra covering the entire capsule, not rough at apex; capsule erect and symmetric, ovoid to oblong-ovoid; urn together with the short neck a little over 1 mm. long; operculum conic; circular stomata sometimes present near the base of the spore sac; peristome teeth broadly triangular; spores reaching 15 μ, mature in summer.

Type locality, Scotland.

ILLUSTRATIONS:—Schwaegr. l. c.; Bry. Eur. *pl. 197;* Braithw. l. c. *B*; *Pl. 3.*

Rare; on sandstone or granitic rock; sometimes found inverted from the roof of caves or clefts; cool shaded places in elevated or northern regions. Newfoundland; Maine; in a cave near the summit of Mount Prospect, Holderness, New Hampshire (Grout); Wilmington Notch, N. Y. (Mrs. Britton).

3a. Var. REPANDA Funck in Sturm, Deutschl. Fl. **2**: heft. 17, plate. 1819.

Tetraphis repanda Schwaegr. Suppl. **2**[1]: 21. *pl. 107.* 1824.
Tetrodontium repandum Schwaegr. l. c. 102.
Georgia repanda C. Muell. Syn. **1**: 181. 1848.

Differs from the species in practically nothing but that the frondiform leaves are replaced by slender flagelliform shoots bearing minute ovate-lanceolate leaves. These become attached to the substratum and produce fertile plants (Limpr. Laubm. **2:** 131).

ILLUSTRATIONS:—Schwaegr. l. c.; Bry. Eur. *pl. 197;* Limpr. l. c. *f. 251; Pl. 3.*

"On shaded rocks near the Glen House, and at Dixville Notch, White Mts." New Hampshire (James); "very rare." Lesq. & James, Manual, 187.

In Rhodora **3:** 184. 1901, Mr. J. F. Collins has some notes on this species. He was unable to detect any flagelliform branches on the New Hampshire plants from the White Mts. in the James Herbarium. I have examined these plants with a moderately high power, dry-mounted, at about 200 diameters, and could not find any of these shoots, but did find frondiform leaves larger than those on my Mt. Prospect plants. Because of the smallness of these frondiform leaves Mr. Collins inclined to the opinion that the American plants should be referred to *Tetrodontium Brownianum* var. *rigidum* (Funck) Jur. and better a form than a variety. To my mind it is hair splitting to call our plants even a form as the only difference seems to be in the development of the frondiform leaves. As the plants were old it may even be that the larger of these leaves had disappeared, as is the case with all the frondiform leaves in mature *T. pellucida.*

Family POLYTRICHACEAE.

The position of this family in a linear arrangement has been regarded very differently by different authors. Fleischer, Brotherus and Mönkemeyer put it last, presumably because of the greater differentiation of the gametophyte, particularly the conduction tissue of the stem. Limpricht, Jennings and others put it between the Acrocarpi and Pleurocarpi. As the distinction between these groups is largely artificial, this arrangement is unsatisfactory. Braithwaite and Dixon place it immediately after the Tetraphidaceae, presumably because of the more primitive type of peristome. This seems the most logical arrangement, as the sporophyte plays much the more important part in the taxonomy of the higher plants. This is the arrangement planned for the Moss Flora, but, due to an unavoidable delay in the preparation of the manuscript, this family will follow the Leucobryaceae instead of being placed here in its proper place. This is solely a matter of convenience to avoid delay in the publication of the work.

Family FISSIDENTACEAE.

A very distinct and homogeneous family related to the *Dicranaceae* in peristome structure but unique in leaf characters. Mostly small plants; *leaves distichous, lying in a single plane, somewhat contorted when dry, apparently split along the basal portion of the upper edge and clasping the stem and the leaf next above;* leaf cells small, smooth, mamillose or papillose, as a rule nearly isodiametric, rarely more than 1.5 : 1 (except near the base), mostly irregularly hexagonal; costa well developed, ending a little below the apex to shortly excurrent (lacking in *F. hyalinus*). Sporophyte lateral or terminal; seta several times longer than the perichaetial leaves (except in subgenus *Octodiceras*); peristome single, of 16 forked, highly colored teeth (in all our species except in *Hallianus*) resembling that of *Dicranum.*

The peculiar structure of the leaf has been explained in several ways but the following explanation is now generally accepted.*

The clasping portion of the leaf represents the original leaf while the rest of the leaf is made up of two lamellae, one dorsal the other terminal. This is strongly confirmed by the structure of the costa and the fact that the supposed lamella is wanting in the perigonial leaves and very much reduced or wanting in the earliest stem leaves. The sheathing base of the leaf is called the vaginant or sheathing lamina; the terminal lamella ventral to the costa, the apical lamina, and the dorsal lamella, dorsal lamina.

We have two genera, *Fissidens* and *Bryoxiphium.*

KEY.

Dorsal lamina well developed, equal in width to the vertical lamina above; peristome well developed ..... 1. *Fissidens.*

Dorsal lamina only slightly developed; peristome lacking ..... 2. *Bryoxiphium.*

FISSIDENS Hedw. Fund. **2:** 91. 1782; Sp. Musc. 152. 1801.

Skitophyllum LaPyl. in Desv. Jour. de Bot. **1814:** 133, 145.

Schistophyllum Brid. Bryol. Univ. **2:** 679. 1827.

Plants with the characters of the family, mostly under 2 cm. in height; stem with central strand; portion of leaf occupied by the vaginant laminae varying but mostly at least ½ the length of the leaf; basal leaf cells usually somewhat larger and more distinct. Capsules oblong to ovoid, erect and symmetric to cernuous and arcuate; peristome teeth mostly strongly incurved when moist, the divisions mostly rough, nodulose or spirally thickened and papillose; operculum conic-apiculate to long-rostrate; calyptra barely

* See "Annals of Botany" **13:** 103–130. 1899.

covering the operculum as a rule, smooth, usually entire or split on one side, rarely mitrate. Type species *F. exilis* Hedw.

The following arrangement of the species seems to follow the natural grouping.

Subgenus 1. EUFISSIDENS Mitt. Central strand present in the stems; leaves unistratose, bordered or not; costa present, strong, extending nearly or quite to the apex; upper leaf cells mostly rounded-hexagonal, more or less irregularly so. Seta longer than the perichaetial leaves; capsule with stomata; peristome teeth well developed, forked nearly or quite to the middle, the divisions slender and variously marked.

Section 1. *Terminales.*

Sporophyte terminal; exothecial cells for the most part shortly oblong-rectangular and collenchymatous with longitudinal walls much thicker than the transverse; divisions of the peristome teeth spirally thickened and finely papillose-roughened.

Subsection 1. **Limbatus** (Sec. *Bryoidium* C. Müll.). Leaves bordered nearly or quite to the apex by one or more rows of narrowly linear echlorophyllose cells: *minutulus* (*pusillus*), *Kegelianus*, *tortilis*, *bryoides*, *viridulus*, *limbatus*, *rufulus*, *sublimbatus.*

Subsection 2. **Semilimbatus** (section *Semilimbidium* C. Müll.). Leaves bordered as in *Limbatus* on the vaginant lamina only and often on the perichaetial leaves alone: *exiguus*, *Hallii*, *obtusifolius*, *Ravenelii*, *Garberi*, *arcticus.*

Subsection 3. **Aloma** C. Müll. (as section). Plants minute; leaves usually crenulate with projecting cell angles, at least on the upper margin, not papillose: *pauperculus*, *Closteri*, *subcrenatus.*

Subsection 4. **Crenularia** C. Müll. (as section). Like *Aloma* but with leaf cells strongly papillose: *Donnellii.*

Section 2. *Laterales.*

Sporophyte lateral in all N. American species except *osmundioides* and *Orcutti;* divisions of the peristome teeth trabeculate, nodose to appendiculate, marked with fine longitudinal or oblique lines between the nodes; leaf cells mostly bulging-mamillose: *taxifolius*, *subbasilaris*, *Bushii*, *adiantoides*, *cristatus*, *polypodioides.*

Subgenus 2. POLYPODIOPSIS C. Müll. Plants minute; stems without central strand; leaves ecostate, loosely areolate; stomata present: *hyalinus.*

Subgenus 3. PACHYFISSIDENS C. Müll. Aquatic or subaquatic; plants stiff and rigid; stems without central strand; leaves bi- tri-stratose except near the margins; stomata lacking: *grandifrons.*

Subgenus 4. OCTODICERAS Brid. (as a genus). Aquatic, long, soft, and floating; central strand lacking; seta shorter or little longer than the perichaetial leaves; stomata lacking: *Hallianus*, *fontanus* (*Julianus*), *manateensis*

KEY.

1.	Plants minute; leaves ecostate (POLYPODIOPSIS)	*27. hyalinus.*
	Plants minute to large; leaves costate	2.
2.	Leaves rigid, opaque, lamina of several layers of cells. (PACHYFISSIDENS)	*28. grandifrons.*
	Leaves soft, unistratose	3.
3.	Plants slender, aquatic and floating (OCTODICERAS)	4.
	Plants terrestrial, or if submerged, not floating (EUFISSIDENS)	6.
4.	Plants rarely over 4 cm. long; seta longer than the capsule	*31. Hallianus.*
	Plants 5–15 cm. long, habit of *Fontinalis*	5.
5.	Seta shorter than the capsule; peristome teeth truncate	*29. Julianus.*
	Seta longer than the capsule; peristome teeth forked and slender-pointed	*30. manateensis.*
6.	Leaves, wholly or in part, bordered with a band of narrow elongated and colorless cells; sporophyte terminal	7.
	Leaves not bordered by narrower elongated cells	22.
7.	Border extending nearly or quite to leaf apex on both sides. (LIMBATUS)	8.
	Border mostly confined to the vaginant laminae. (SEMILIMBATUS)	17.
8.	Leaf border confluent with the costa in most leaves. (*tortilis* may be sought here)	*5. bryoides.*
	Leaf border ceasing below apex	9.

9.	Plants 1–5 cm. long, usually submerged (Pacific Coast)	*8. rufulus.*
	Plants rarely over 5 mm., not submerged except at high water	10.
10.	Capsules symmetric, erect to inclined	11.
	Capsules more or less unsymmetric, inclined to horizontal	16.
11.	Border of vaginant lamina edged with small short cells below	12.
	Border of vaginant lamina not so edged	13.
12.	Costa reaching apex; capsules mostly inclined and unsymmetric	*6. limbatus.*
	Costa ending several cells below the apex; capsules mostly erect and symmetric	*7. sublimbatus.*
13.	Synoicous; leaf cells about 8 μ in diameter, those of the vaginant laminae little or not at all enlarged	*3. tortilis.*
	*Dioicous; most leaf cells larger than 8 μ	14.
14.	Plants 5–25 mm. high	*4. viridulus.*
	Plants rarely 3 mm. high	15.
15.	Leaf cells of the vaginant laminae reaching twice the dimensions of the dorsal and ventral	*2. Kegelianus.*
	Leaf cells of vaginant lamina only occasionally noticeably larger than those of the dorsal and ventral	*1. minutulus.*
16.	Leaves mostly oblong-lingulate, more or less apiculate; border nearly reaching the apex	*4a.* Var. *tamarindifolius.*
	Leaves oblong-lanceolate; border ceasing some distance below the apex; plants of the Gulf States	*4b.* Var. *texanus.*
17.	Costa percurrent to excurrent	*13. Ravenelii.*
	Costa usually ending 2–several cells below the apex	18.
18.	Leaf cells finely papillose	*14. Garberi.*
	Leaf cells not papillose	19.
19.	Leaves narrowly oblong, finely and evenly crenulate above with projecting cell angles	*11. Hallii.*
	Leaves oblong-lanceolate, entire or with upper margins slightly irregular	20.
20.	Leaves acute with a nearly percurrent costa	21.
	Leaves rounded-obtuse; costa ending several cells below the apex	*12. obtusifolius.*
21.	Dorsal lamina reaching the stem in most leaves	*9. exiguus.*
	Dorsal lamina not reaching the stem in any leaves	*10. arcticus.*
22.	Plants minute, about 0.5 mm. high, almost stemless	*15. Closteri.*
	Plants 2–50 mm. high; stem well developed	23.
23.	Leaves coarsely and irregularly crenulate-serrate above; sporophyte lateral	24.
	Leaves either entire or finely and evenly crenulate by projecting cell angles	26.
24.	Costa ending several cells below the leaf apex; costa covered above with short mamillose cells; leaves not bordered	*23. subbasilaris.*
	Costa percurrent; leaves (with few exceptions) with a distinct border of lighter cells; cells of costa all long and narrow	25.
25.	Leaf cells 6 x 9–12 μ; border very distinct	*25. cristatus.*
	Leaf cells 12–15 x 18–24 μ; border often indistinct	*24. adiantoides.*
26.	Leaf margins finely and evenly crenulate by projecting cell angles	27.
	Leaf margins entire, at times somewhat irregular in outline	31.
27.	Leaf cells papillose with a single large papilla	*18. Donnellii.*
	Leaf cells smooth or merely bulging-papillose	28.
28.	Sporophyte terminal	29.
	Sporophyte lateral	30.
29.	Costa ending several cells below the apex	*21. osmundioides.*
	Costa percurrent	*22. Orcutti.*
30.	Costa stout, usually short-excurrent, occasionally percurrent	*19. taxifolius.*
	Costa slender, nearly or quite percurrent	*20. Bushii.*

*See p. 11.

31. Plants large, 2–5 cm. long; sporophyte lateral ..... *26. polypodioides.*
Plants 1.5–5 mm.; sporophyte terminal ..... 32.
32. Leaves oblong-lingulate, rounded-obtuse ..... *12. obtusifolius.*
Leaves linear-lanceolate, acute ..... 33.
33. Costa ending 1–2 cells below leaf apex ..... *17. subcrenatus.*
Costa ending 8–10 cells below the leaf apex ..... *16. pauperculus.*

1. FISSIDENS MINUTULUS Sull. Mem. Am. Acad. n. s. **3:** 58. *pl. 2.* 1848.

Fissidens viridulus var. *pusillus* Wils. Bryol. Brit. 303. 1855.
Fissidens pusillus Wils. in Milde, Bryol. Siles. 82. 1869.
Fissidens incurvus var. *pusillus* Schimp. Syn. (Ed. 1) 104. 1860.
Fissidens pusillus var. *madidus* Spruce, Journ. Bot. **18:** 361. 1880.

Plants very small, 1–3 mm. long, 5 mm. at the utmost; lower leaves small and in young plants often scarcely margined, the upper, especially the perichaetial, narrowly lanceolate, often somewhat curved, 0.24–0.3 x 1–1.2 mm., at most 0.45 mm. wide in the stem leaves, usually in 3–4 pairs, occasionally more, acute, often apiculate; costa percurrent in the upper leaves; border mostly ending below the apex and apical margin usually somewhat irregular to faintly serrulate; vaginant lamina about ½ the length of the leaf, the sides often unequal; dorsal lamina narrowed at base and reaching the stem in the upper leaves only, as a rule; leaf cells irregularly quadrate to rectangular-hexagonal, about 10 μ in diameter but varying greatly in size and shape, some reaching 15 μ in longest dimension, those of the vaginant lamina near the costa often elongated to 22 μ. Mostly dioicous; seta 3–4 mm. long; capsule erect or inclined, strongly contracted below the mouth when dry and empty, obovoid; urn reaching 0.7 mm. in length but usually shorter; operculum conic-apiculate to rostrate, often nearly as long as the urn; exothecial cells quadrate to rounded-hexagonal above, rectangular below with rounded corners, collenchymatous, longitudinal walls much thicker than the transverse; peristome teeth deep red, deeply cleft, very rough and subspirally thickened with rather obscure markings; spores about 15 μ, *ripening August to September,* (occasionally as late as November at Washington, D. C.).

Type locality, N. Eastern U. S.

ILLUSTRATIONS:—Sull. l. c. & Icones Musc. *pl. 24;* Braithw. Brit. Moss. Fl. **1:** *pl. 10 B;* M. H. M. *f. 23;* Jennings, Mosses Western Pa., *pl. 10; Pl. 5.*

EXSICCATI:—Drumm. Musc. Am. S. States 39 & 40 (as *F. bryoides* vars.); Sull. Musc. Allegh. 183 (the type); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 80 (or at least in part); Aust. Musc. Appal. 102; Holz. Musc. Acro. Bor. Am. 105, 105b; Grout, Musci Perf. 182.

Common on wet rocks in cool shaded places, occasionally on moist banks, rarely found on limestone; eastern Canada and the U. S. south to the Gulf; occasionally found west of the Rockies.

The confusion in the N. American *Limbati* is so great that a satisfactory arrangement is scarcely possible at present because there are such great variations in size, inflorescence, border and shape of capsule within the recognized specific limits. Sullivant, Icones Musc. 37, says of *minutulus* "caulis 2–3 lineas vel ultra," i.e. 4–6 mm. Barnes, Bot. Gaz. **12:** 6, says 1 mm. or less. Dixon, Handb. Brit. Mosses (Ed. 3) 126, says that the var. *madidus* Spruce of *F. pusillus* is a synonym of *F. minutulus* and is larger than typical *pusillus.* I agree with Cardot and Brotherus that *pusillus* is a synonym of *minutulus,* but I feel sure that *minutulus* merges into *viridulus* and that *viridulus* in turn merges into *bryoides* through their varieties. *Bryoides* in turn seems to have developed into the subspecies *limbatus* on the Pacific coast. The confusion is made still greater by the fact that no two authors mean exactly the same thing by the names they use. I feel sure that what Barnes called *incurvus* was a composite of forms of *minutulus, viridulus, bryoides* and occasionally *limbatus,* having curved capsules. The summer maturing of the spores may prove one of the best means of identifying *minutulus.*

2. FISSIDENS KEGELIANUS C. Müll. Linn. **21:** 181. 1848; Syn. Musc. **1:** 49. 1849.

Fissidens clavipes Sull. Proc. Am. Acad. **5:** 275. 1861.
Fissidens monandrus Mitt. Jour. Linn. Soc. **12:** 588. 1869.
Fissidens trinitensis Hampe, in Jaeg. Adumb. **1:** 123. 1874–5.
Fissidens flexifrons Besch. Rev. Bryol. **18:** 51. 1891 (in part).
Conomitrium crassicaule Besch. l. c.

Differs from *F. minutulus* in the more slenderly acuminate, narrowly oblong-lanceolate leaves, bordered by a stronger border reaching almost or quite to the costa and often finely but sharply toothed near the

apex, sometimes nearly entire; leaf apex much like that of *F. bryoides*, but the plants are much smaller and the leaves narrower; basal cells especially those of vaginant laminae much larger than those of the upper leaf (12 μ), variable in size, up to 15 μ wide 30 μ long but the broadest cells are not the longest. Dioicous*; capsule erect and symmetric, urn 0.4–0.6 mm. long, obconic to obconic-cylindric, contracted under the mouth when dry and empty; operculum long-rostrate, sometimes nearly as long as urn; spores smooth, about 9 μ in diameter, mature in late spring or early summer.

Type locality, Dutch Guiana. *Pl. 7E.*

The cells of the vaginant laminae of *F. minutulus* are often somewhat enlarged next the costa but only to a slight degree as compared with this species.

According to Mrs. Britton (Bryol. **26**: 1. 1923) this species is common in subtropical America, ranging from southern Florida, Cuba, Haiti, Jamaica, Porto Rico, St. Thomas, St. Croix, Antigua, Guadeloupe and Martinique to Trinidad and Dutch Guiana, also in Mexico.

This seems near to *F. minutulus* and should probably be regarded as a subtropical variant. In Florida it is widely distributed from Polk Co. southwards, usually on limestone. It is also found on the bases of palms and on soil, especially clay.

3. FISSIDENS TORTILIS Hampe & C. Muell. Bot. Zeit. **22**: 340. 1864.

Similar to *F. bryoides* but dioicous; small, light yellowish, crisped, simple; leaves a few pairs, the lower remote, the upper close, when moist slightly crisped-undulate, lanceolate (*latiuscula lanceolata*), bordered throughout with a whitish subentire border; dorsal lamina narrowed toward the base; vaginant lamina more widely bordered, apical lamina with whitish costa vanishing in a very short mucro; leaf cells small, hexagonal, subopaque, more pellucid with age; perichaetial leaves similar; seta short, ascending, flexuous, becoming purple; capsule erect, symmetric, oblong, small; *operculum conic*, acute, oblique; annulus very narrow, persistent; antheridia few, on a separate plant in a terminal bud. (Translated from the original description.)

A miniature of *F. bryoides* similar in general appearance to *F. Kegelianus*, the plants seem a little larger with up to 12 pairs of leaves, usually with fewer; dorsal lamina attenuate below, often not reaching stem; leaf cells about 8 μ in diameter, hexagonal, those of the base and vaginant lamina little different; spores in winter.

Type locality, Mexico.

Specimens from Mexico have the border fused with the costa at the apex and entire; in specimens from Honduras the costa is excurrent for a cell or two, and the border does not quite reach the apex, which is almost or quite entire; in the Pineola, Florida, specimens the apex is like the Honduran except that it is often finely and sharply toothed with projecting cell angles and the costa usually vanishes in the apex. Plants from Pineola are synoicous, but there are other small plants bearing a few antheridia in a terminal bud. It is possible that these may have been attached to the female plants at base and broken apart in scraping from the limestone. Fern Grottoes, Pineola, Florida, Jan. 1936 (Grout). These Grottoes are a noted locality for rare ferns. *Pl. 7D.*

F. angustifolius Sull., whose type is Wright's Cuban Mosses no. 18, is a similar species likely to be found in Florida. It differs from *F. tortilis* in the longer and relatively narrower leaves, costa barely excurrent and more frequently fused with the border at the apex; the operculum is nearly as long as the urn, the exothecial cells are collenchymatous, quadrate with rounded corners. The basal areolation is larger and looser than that in *F. Kegelianus*, the leaf cells are smaller, about 7 μ, otherwise the two species are hard to distinguish.

4. FISSIDENS VIRIDULUS (Web. & Mohr) Wahlenb. Fl. Lapp. 334. 1812.

Dicranum viridulum Web. & Mohr Bot. Taschenb. 161. 1807.

Fissidens bryoides Hedw. Stirp. Crypt. **3**: *pl. 29.* 1792 (not of Sp. Musc. 153. 1801, according to Limpricht, Laubm. **1**: 429. 1887).

Fissidens exilis Funck, Moostasch. *pl. 22.* 1821 (not of Hedw. Sp. Musc. 152. 1801, according to Braithwaite).

Fissidens incurvus DeNot. Epil. 485, in part; Bry. Eur. *pl. 99*, in part; Schimp. Syn. (Ed. 1) 104. 1860 and (Ed. 2) 112. 1876.

Fissidens bryoides intermedius R. Ruthe, Rabenh. Bryoth. Eur. no. 1160. 1872.

Fissidens impar Mitt. Jour. Linn. Soc. **21**: 554. 1885.

* Originally described as dioicous. Mitten (Journ. Linn. Soc. **12**: 598. 1869) says monoicous in all the specimens he saw.

Fissidens bryoides var. *Hedwigii* Limpr. l. c.
Fissidens bryoides var. *viridulus* Broth. Laubm. Fennosk. 18. 1923.

(The *Dicranum viridulum* of Smith. Fl. Brit. 1230. 1804 was a wrong identification of a plant of *F. incurvus*, referring it to *Dicranum viridulum* Sw. Musc. Suec. 84. 1799.)

Plants about the size of *F. bryoides;* leaves typically *rounded-obtuse and apiculate; margin not reaching the apex*, often lacking in young leaves except on the vaginant lamina. Capsule symmetric, erect or inclined.

Type locality European.

ILLUSTRATIONS:—Bry. Eur. l. c.; Braithw. l. c. *pl. 12* C & D; Pl. 5C.*

On moist shaded soil; New England to Vancouver Id., south to the Middle Atlantic States, rare west of the Rockies. A sterile form approaching the European *F. crassipes* has been collected on stones in streams at Strathaven, Pa. (Krout) and at Raleigh, N. Carolina (Blomquist).

So closely related to *F. bryoides* that it is often difficult to distinguish from it. On the other hand sterile plants are often hard to distinguish from *F. minutulus.*

Plants collected in a well at New Haven, Connecticut by Browne in 1878 and named *F. bryoides caespitans* by Eaton are almost perfect *F. viridulus*, rather slender because of the shaded habitat. I have seen no American *caespitans.*

Dixon's note (l. c.) that "the long, very acute leaves distinguish this plant (i. e. *F. pusillus*) from *F. viridulus*, but specimens may often be found with the leaves broader and more approaching that plant," is in the main true, but I find narrow leaves on plants that mature spores in late autumn. Immature plants are mostly indistinguishable.

4a. Var. TAMARINDIFOLIUS (Brid.) **n. comb.**

†*Fissidens tamarindifolius* Brid. Bryol. Univ. 684. 1827 (in part); Mitt. Jour. Linn. Soc. **21:** 557. 1885.
Fissidens incurvus var. *tamarindifolius* Braithw. Brit. Moss Fl. **1:** 69, 82. *pl. 12*H.* 1887.

Differs from the species in no important particular except a curved and more or less inclined capsule. With the species. While not positively sure this is the correct name for these forms, the plants themselves agree with the description. *Pl. 5H.*

4b. Var. TEXANUS (Lesq.) **n. comb.**

Fissidens texanus Lesq. & James, Manual 86. 1884.
Fissidens incurvus var. *brevifolius* R. & C. Bot. Gaz. **14:** 94. 1889.

Leaves oblong-lanceolate, acute to acuminate; border mostly ending some distance below the apex and more or less lacking on the lower leaves and those of young plants; perichaetial leaves narrower and more narrowly acute above. Capsules more or less unsymmetric, inclined to arcuate.

Type locality, Texas.

Very common on bases of trees, cypress knees and less frequently on stones in swampy places in the Gulf States; also in Georgia.

There is no absolute certainty that this common form is the *F. texanus* of Lesq. as no trace of the type is to be found.

It is common and likely to be noted as different from the general run of what was known as *F. incurvus.* It was collected at Caloosa, Florida by J. D. Smith in 1878 and called *F. incurvus*, but it is easily distinguished from the northern form as noted above. The leaf apex is like that of *F. taxifolius* except that it lacks the border.

5. FISSIDENS BRYOIDES Hedw. Sp. Musc. 135. 1801.

Fissidens synoicus Sull. Mosses U. S. 103. 1848.
Fissidens inconstans Schimp. Syn. (Ed. 2) 114. 1876.

Stems 5–25 mm. high; leaves few to many pairs, oblong, rather abruptly short-acuminate in typical forms, in others more obtuse and apiculate, the upper and perichaetial 1.5–2 mm. long; vaginant lamina ½ the length of the leaf; border strong, especially on the vaginant lamina, *typically confluent with the costa at the leaf apex* but often vanishing slightly below it; leaf cells variable in size and shape, mostly irregularly hexagonal, 8–12 μ. Autoicous; ♂ buds in the lower leaf axils. *Capsule typically erect and symmetric*, sometimes inclined; median exothecial cells mostly oblong with very thick longitudinal walls; spores in winter.

Type locality, Germany.

† See Potier la Varde, Rev. Bryol. **41:** 85 and 94.

ILLUSTRATIONS:—Bry. Eur. *pl. 101* (as *F. exilis*); Braithw. Brit. Moss Fl. **1**: *pl. 10E;* M. H. M. *f. 21.*
EXSICCATI:—Drumm. Musc. Am. 113 (in part); Sull. Musc. Allegh. 185; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 82; Aust. Musc. Appal. 100; Holz. Musc. Acro. Bor. Am. 80b; Grout, Musci Perf. 173.

Mostly on moist soil; Canada and the U. S. east of the Rockies, south to the Gulf; Vancouver Id., Macoun, Can. Musci 121; on limestone, in Deering Hammock near Miami, Fla. Most specimens from the Pacific coast prove to *F. limbatus.*

The time of maturing spores and the broader perichaetial leaves with the erect capsule, seem the best characters for distinguishing this species from *F. minutulus.* The difference in the exothecial cell walls is doubtfully important. As regards leaf border, leaf cells, shape of capsule and peristome structure there is little constant difference between the two. I believe Monkemeyer is right in making *incurvus* a variety of *bryoides* as the reported differences in inflorescence, shape of capsule and leaf structure are either negligible or exceedingly inconstant.

5a. Var. INCURVUS (Starke) Monkem. Laubm. Europ. 142. 1927.

Fissidens incurvus Starke Ms. in Web. & Mohr, Bot. Taschenb. 161. 1870.
Fissidens Bambergeri Schimp. Syn. (Ed. 2) 115. 1876.

Leaf border less often reaching apex; capsules curved and cernuous.

Type locality, Germany.

ILLUSTRATIONS:—Jennings, Mosses W. Pa. *pl. 10;* Braithw. Brit. Moss Fl. **1**: *pl. 10C; Pl. 5* (as *F. bryoides*).

This is the *F. incurvus* of most European authors and exsiccati. Plate 99 of the Bry. Eur. represents *F. viridulus* and its var. with curved capsules, which I believe to be the *F. tamarindifolius* of Bridel, Braithwaite, and Limpricht. It would have been much better had *F. bryoides* been described as having both erect and curved capsules and no variety named.

In my opinion *F. incurvus* has been so puzzling because it has been a composite species as treated by most authors. It has included *F. tamarindifolius* Brid., *F. texanus* Lesq. and by many, forms of *F. limbatus* Sull. also. The distinctions between these are not always clear cut but the differences are usually ascertainable by careful study. Most of the *F. incurvus* in American herbaria are of the other forms mentioned above.

*6. FISSIDENS LIMBATUS Sull. Pac. R. R. Rept. 4: 185. *pl. 1.* 1857!

Scarcely to be distinguished from broad-leaved forms of the var. *incurvus* of *F. bryoides* (of which species it is best regarded as a subspecies) except by the *smaller, more uniform and more regularly arranged leaf cells, usually not more than 10 μ in diameter and arranged in almost regular longitudinal rows;* the margin is also rather wider on the vaginant lamina, sometimes *with shorter cells on the outer edge,* and it usually ends a little below the leaf apex. Antheridial buds usually frequent and conspicuous in the lower leaf axils. Capsules light brown, *inclined to horizontal and somewhat unsymmetric,* contracted below the mouth when dry and empty; spores in winter.

Type locality, California.

ILLUSTRATIONS:—Sull. l. c.; *Pl. 6A.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 105; Holz. Musc. Acro. Bor. Am. 279, 356, and 80 as *F. bryoides,* 480 as *F. incurvus;* Grout, Musci Perfecti 232 and 297 as *F. incurvus;* Baker, Pacific Coast Bryophytes, 373.

Moist shaded soil; California to New Mexico, Vancouver Island and Alberta; apparently common in California at least.

Although the distinctions between this and forms of the preceding are so slight, they seem pretty constant. In some tufts there may be some capsules erect and symmetric. *F. pusillus brevifolius* R. & C., Baker, Pacific Coast Bryophytes 368, det. by Cardot (perhaps published elsewhere) is a form of *F. limbatus* with unusually narrow leaves; the perichaetial leaves are linear-lanceolate to sword-shaped and acuminate. The plants are apparently dioicous. For it I propose the name

6a. Var. ENSIFORMIS **n. var.**

Folia angusta; folia perichaetialia anguste lanceolata, acuminata.

Collected also at Berkeley, California, Feb. 6, 1892 (M. A. Howe), Placer Co., Calif. (F. A. MacFadden), Oregon and Arizona (J. B. Leiberg).

7. FISSIDENS SUBLIMBATUS **n. sp.**

Pusillus, simplex; folia oblongo-lingulata, inferiora remota, superiora conferta, ubique limbata, nisi in apice obtusa mutica et denticulata; lamina dorsalis supra basin abrupte enata; lamina duplicaturae latius limbata cum cellulis quadratis in margine; costa sub apice finiente; capsula aequalis, obovata, 1 mm. longa.

Plants smaller than *limbatus* or *viridulus;* leaves oblong-lingulate, distant below, crowded above, 1–1.5 mm. long, *obtuse and minutely toothed and apiculate at the apex* with border not reaching apex; dorsal lamina ending some distance from the stem, *usually ending abruptly;* border of the vaginant lamina wide and edged below with 1–2 rows of *short subquadrate cells;* leaf cells obscure, bulging, the upper about 7 μ wide, subquadrate, regular and arranged in perceptible rows, longitudinal and transverse; *costa ending a few cells below the apex;* capsules small, erect and symmetric or nearly so, urn about 1 mm. long, obovoid; operculum short-rostrate; exothecial cells quadrate with rounded corners, collenchymatous; spores in winter.

Type locality, shaded ledge, Tanque Verde Mts., Pima Co., Arizona, Feb. 19, 1927 (E. B. Bartram, no. 1613). Type in Herb. Bartram. Also collected in two other localities in Arizona by Bartram, nos. 1296 & 1554 and by Orcutt in New Mexico, Guadalupe, Co. no. 7168.

ILLUSTRATION:—*Pl. 13A.*

Resembles *F. limbatus* in the small regularly arranged leaf cells and the wide border of the vaginant lamina, edged with small short cells.

8. FISSIDENS RUFULUS Bry. Eur. fasc. 46–47, Suppl. *pl. 102.* 1851.

Fissidens ventricosus Lesq. Mem. Calif. Acad. Sci. **1**: 7. 1868.
Fissidens hydrophilus Jaeger, Enum. Fissid. 20. 1869.

Plants largest of the LIMBATI, 1–3 cm. high, rarely more, dark green, blackish below, sparingly branched, with dark rhizoids among the leaves; leaves oblong-cultriform, obtuse to apiculate, 1.5–2.5 mm. long; costa strong, ending in the apex; *border nearly or quite as large in the upper ¼ of the leaf as elsewhere, almost reaching the apex;* vaginant lamina ½–⅔ the length of the leaf; dorsal lamina reaching the stem; leaf cells irregularly hexagonal, upper median 8–12 μ in longest dimension, the lower larger. Dioicous; seta 3–4 mm. long; capsule symmetric, erect or slightly inclined, urn 1–1.4 mm. long; operculum conic; peristome teeth less roughened above and with spiral thickenings more pronounced than in the others of our LIMBATI; spores 20–28 μ, maturing in winter.

Type locality, Germany.

ILLUSTRATIONS:—Bry. Eur. l. c.; Braithw. Brit. Moss Fl. **1**: *pl. 11B;* Dixon & Jam. Handb. Brit. Mosses (Ed. 3) *pl. 16K;* Sull. Icones Musc. *pl. 30; Pl. 6B.*

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 107; Grout, Musci Perf. 309.

On submerged rocks in streams; California to Washington and Idaho. Rare. The leaves of American plants as a rule are wider than those of the European and the red at base of stems found in the latter is apparently lacking in the American plants. In Holzinger's 107 the strong border all but reaches the slightly excurrent costa, approaching the European *F. rivularis* in this respect. All of our LIMBATI are variable and puzzling and seemingly intergrading. *F. rufulus* seems to be the only one in which there is any noticeable difference in the teeth. The exothecial cells vary little from those described for *F. pusillus.* The seta is usually much longer than the perichaetial leaves in *F. rufulus,* Sullivant's figures notwithstanding.

9. FISSIDENS EXIGUUS Sull. Mem. Am. Acad. Sci. n. s. **3**: 60. *pl. 2.* 1846.

Fissidens viridulus var. *Lylei* Wils. Bryol. Brit. 304. 1855.
Fissidens pusillus var. *Lylei* Braithw. Brit. Moss. Fl. **1**: 68. 1885.
Fissidens incurvus var. *exiguus* Barnes, Bot. Gaz. **12**: 6. 1887; Aust. Musc. Appal. no. 103. 1870.

Plants *very small, 1–2 mm. high;* leaves 3–6 pairs, narrowly oblong-lanceolate, acute to rounded-obtuse, the upper reaching 1 mm. in length, perichaetial a little longer, all smooth; margin entire or rarely slightly irregular near apex; in most cases only vaginant lamina of perichaetial leaves bordered; *costa usually vanishing 2–3 cells below apex;* upper median leaf cells 8–15 μ in longest dimension, irregularly rounded-hexagonal. Dioicous; seta 2–4 mm. long, pale; capsule erect and symmetric or somewhat inclined, urn reaching 0.6 mm. long; exothecial cells oblong, strongly collenchymatous; operculum long-conic to short-rostrate, *about ⅔ the length of urn;* divisions of peristome teeth spirally thickened and very strongly papillose; spores 15–20 μ, mature in summer.

Type locality, near Columbus, Ohio.

ILLUSTRATIONS:—Sull. l. c. & Icones Musc. *pl. 23;* Jennings, Mosses W. Pa. *pl. 11; Pl. 5.*

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 79, (Ed. 2) 80 (in part according to Barnes l. c.); Aust. Musc. Appal. 103.

On stones in moist shaded places; King Oscar Land, southeastern Canada and northern U. S. east of the Rockies, south to North Carolina; not common. Occasional plants have a very narrow border on the dorsal and vertical lamina.

9a. Var. FALCATULUS (R. & C.) **n. comb.**

Fissidens falcatulus R. & C. Bot. Gaz. **19**: 237. *pl. 21.* 1894.

Differs in the less crowded outwardly curved leaves, vaginant lamina of all leaves narrowly bordered with border sometimes extending a little beyond the vaginant lamina.

R. & C. Musc. Am. Sept. no. 210 has been seen. It is from the type locality and collector and fits the figures and description exactly.

Type locality, on bark of trees Catahoulou near Mandeville and Bayou Alexandre, Louisiana, 1890–1891 (A. B. Langlois).

9b. Forma EMARGINATUS **n. f.**

Folia lingulata, obtusa, breve apiculata, immarginata.

Leaves lingulate, rounded-obtuse and short-apiculate; border lacking in most plants. Type on the ground, Chincahŭa Mts., Arizona, alt. 4000 ft., Feb. 1906 (Leiberg no. 805).

10. FISSIDENS ARCTICUS Bryhn, Bryophyta in Itin. Polari Norv. Secundo Coll. 57. *pl. 1, f, 2.* Kristiana. 1906.

Plants gregarious or intermixed with other bryophytes, bright green, darker with age; stems erect, naked at base, 5–20 mm. high, simple or sparingly branched, with the leaves scarcely 1.25 mm. wide; leaves usually 6–12 pairs, erect-open, lanceolate, acute, often faintly serrate near apex, reaching 1 mm. in length; costa mostly ending a little below the apex; vaginant lamina extending at least ⅔ the length of the leaf, bordered by a narrow margin of linear cells; dorsal lamina not reaching the stem, often ending ⅓ the length of the leaf from the base, not bordered; leaf cells irregularly four-sided to hexagonal, 7–10 μ in diameter, not much rounded at the angles. Sporophyte unknown.

Type locality, King Oscar Land. *Pl. 9B.*

Also found in Greenland.

The Greenland plants have been examined through the kindness of Dr. Johannes Lid of the Oslo Museum. The notes following were made on these plants while the above description was adapted from the original description in Latin.

Distinguished from *F. exiguus* by the smaller size, smaller and more distant leaves, not or barely overlapping, faintly toothed at the apex; dorsal lamina ending some distance from the leaf base; all leaves, except the minute basal, margined on the vaginant lamina and the margin often extending slightly onto the apical lamina; costa with few exceptions ending perceptibly below the apex. The leaves at the base of the stem are very small, gradually growing larger and then suddenly becoming smaller again, then again gradually becoming larger, this alternation repeated 2–3 times. This seems to indicate a seasonal growth for 2–3 years or more.

11. FISSIDENS HALLII Austin, Bot. Gaz. **2**: 97. 1877.

Fissidens Austini Barnes, Bot. Gaz. **12**: 32. 1887.

Plants small, 2–4 mm. high; leaves 4–8 pairs, *narrowly oblong, acute,* the upper and perichaetial largest, reaching 1.5 mm. in length, *finely and regularly crenulate on the upper margin, smooth;* vaginant lamina about ½ the length of the leaf, with a few narrower elongated cells at the basal edge; costa pale, subpercurrent; upper median leaf cells not incrassate, rounded-hexagonal to subquadrate, 7–10 μ in diameter. Sporophyte terminal; seta 2–3 mm. long; capsule obovoid, erect and symmetric, urn 0.5–0.75 mm. long; exothecial cells not incrassate, oblong-rectangular, with longest dimension longitudinal at base, transverse in the middle, several rows of smaller hexagonal cells below the mouth; operculum long rostrate, a little shorter than the urn; divisions of the peristome teeth papillose and spirally thickened; spores in spring.

Type locality, Texas (Hall). *Pl. 12A.*

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 409. (As *F. falcatulus.*)

On bark of trees and logs in damp places; Florida (Rapp, Grout).

The plant described above is not rare in certain parts of Florida and is a good species, almost certainly the *F. Hallii,* of Austin. It seems doubtful if there is enough of a border to put this in the *Semilimbati.*

The narrower, more acute leaves with smooth leaf cells distinguish this from *F. Garberi;* the subpercurrent costa and the smooth leaf cells from *F. Ravenelii* and *F. Donnellii.*

12. FISSIDENS OBTUSIFOLIUS Wils. Jour. Bot. 4: 196. *pl. 9.* 1845.

Plants *small, fertile, 2–3 mm. high,* sterile up to 1 cm., pale green, scattered to gregarious; stems simple or sparingly branched; leaves 4–8 pairs, the lower minute and distant, upper larger and crowded, upper about 1 x 0.4 mm., *oblong-lingulate, rounded-obtuse, entire;* vaginant laminae ½–⅔ the length of the leaf; *upper perichaetial leaves in most cases faintly bordered at the very base by a few inconspicuous elongated cells; costa ending a few cells below the apex;* dorsal lamina mostly tapering, sometimes not quite reaching the stem; upper median leaf cells 7–10 μ in the longest dimension, irregularly rounded-hexagonal to oblong, larger next the costa, smaller at the margin, *smooth;* slender sterile shoots often present, with numerous small distant almost elliptical leaves; many shoots, both fertile and sterile, seem to extend themselves by subapical innovations. Dioicous; sporophyte terminal; seta comparatively stout, 2–3 mm. long; capsule erect and symmetric, oblong-obovate, urn *0.5 mm. or less in length;* operculum *conic-apiculate to subrostrate;* exothecial cells shortly oblong-rectangular, collenchymatous; divisions of peristome teeth papillose, obscurely thickened spirally; *spores 18–25* μ, mature in autumn.

Type locality, Columbus, Ohio.

ILLUSTRATIONS:—Wils. l. c.; Sull. Icones Musc. *pl. 22;* M.H. M. *f. 24;* Jennings, Mosses Western Pa. *pl. 10; Pl. 8.*

EXSICCATI:—Sull. Musc. Allegh. 181; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 78, (Ed. 2) 99; Aust. Musc. Appal. Suppl. 480; Holz. Musc. Acro. Bor. Am. 106.

On wet rocks, often submerged at high water; New England to Minnesota, Kansas and Colorado, south to Texas, Louisiana, Alabama and W. Virginia. Probably not rare but overlooked because of its small size. Occasional plants in sods of typical character will have narrower leaves with an almost triangular apex. The faint margin at the base of the vaginant laminae is usually present but difficult of demonstration. The relationship of this species to the *semilimbati* and *F. exiguus* is obvious, especially when we consider the var. *kansanus.*

12a. Var. KANSANUS R. & C. Bot. Gaz. **15:** 40. 1890.

"Differs from the typical form in its leaves with a broad border of elongated cells on the margins of the vaginant laminae, and a narrow less distinct border on the dorsal wing."

Type locality, Saline Co., Kansas (Henry). *Pl. 7B.*

Bartram's 104 from the Patagonia Mts. Southern Arizona, Feb. 17, 1924, has the border on the vaginant laminae of the fully developed leaves but not on the dorsal lamina.

12b. Var. APICULATUS **n. var.**

Folia angusta, angustius obtusa, apiculata, superiora 1.4 x 0.35 mm.; costa percurrente in apicem; margine apicis non nunquam flexuoso.

Leaves narrower in proportion to length, the upper reaching 1.4 x 0.35 mm., narrowly obtuse, mostly apiculate; costa usually percurrent into the apiculus. Type Bartram's 1187, bank of dry wash, Empire Mts., Pima Co., Arizona, alt. 5000 ft., Nov. 3, 1924. Type in herb. Bartram.

The size of the leaf cells, the occasional traces of border on the margin of the vaginant lamina, dorsal lamina usually attenuate and not reaching the leaf base, indicate a close relationship to *F. obtusifolius.* Occasional leaves show papillae so faint as to be noted with extreme care only. The sporophyte is needed to settle the relationships of this plant definitely.

13. FISSIDENS RAVENELII Sull. Mem. Am. Acad. n. s. 4: 171. *pl. 2.* 1849.

Plants small, 2–4 mm. high; stems simple, radiculose at base only; leaves 2–10 pairs, oblong-lanceolate, acute, upper 1 mm. or more in length, finely crenulate by projecting cell angles, bordered on the vaginant lamina only; border strong, of 3 or 4 rows of cells; vaginant lamina about ½ length of leaf; *costa strong, percurrent to subexcurrent* in all but a few of the lower leaves; leaf cells small, ± 5–7 μ, irregularly quadrate to hexagonal, *with about 2 papillae, obscure.* Monoicous or dioicous, ♂ inflorescence axillary or attached to the base of the ♀ plants by radicles; seta 3–5 mm. long; capsule oblong-ovoid, erect and symmetric, urn 0.7–0.8 mm. long, contracted below the mouth when dry and empty; exothecial cells collenchymatous, subquadrate to short-rectangular; operculum conic-rostrate, more than ½ the length of the urn; divisions of the peristome teeth spirally thickened, papillose-roughened; spores 7–9 μ, mature in spring.

Type locality, South Carolina.

ILLUSTRATIONS:—Sull. l. c. and Icones Musc. *pl. 25; Pl. 8A.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 81, (Ed. 2) 192; Aust. Musc. Appal. Suppl. 481; Holz. Musc. Acro. Bor. Am. 153; Small, Mosses Southern U. S. 29; Grout, Musci Perf. 209.
On damp bricks, stones or soil: North Carolina to the Gulf, frequent in Florida.
The percurrent costa easily distinguishes this from *F. Donnellii* and *F. Garberi* which most resemble it. The bulging cells of the exothecium do not show after the capsule is thoroughly soaked up.

14. FISSIDENS GARBERI Lesq. & James, Proc. Am. Acad. **14**: 137. 1879!

Plants small, about the same size and general appearance of the last, both macroscopically and microscopically. Leaves broader, oblong and obtuse, occasionally oblong-lanceolate and acute; border rather faint and found only on the lower part of the vaginant lamina, often difficult of demonstration; vaginant lamina rather more than ½ the length of the leaf; *costa ending several cells below the leaf apex; leaf cells obscure, papillose, 5–7 μ*; spores Feb.–March. *Pl. 15A.*
Type locality, Florida.

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 410, 435; Grout, Musci Perf. 195.
On base of trees, dead wood and limestone rocks; Florida to Louisiana. Apparently frequent in southern and central Florida; also from Honduras. Sterile, it can be distinguished from *F. Donnellii* most easily by the 2–4 papillae on each leaf cell.
The *F. Garberi* and *F. Ravenelii* reported from Ontario are evidently errors. Plants so named in the herbarium of the Canadian National Museum were wrongly determined.

15. FISSIDENS CLOSTERI Aust. Bull. Torr. Club. **5**: 21. 1874.

Plants minute and almost stemless; leaves 2–3 pairs, the lower ovate with little or no dorsal lamina, the upper lanceolate from an ovate base, about 0.4–0.6 mm. long; border lacking; margin entire or wavy above; vaginant lamina about ½ the length of the leaf; dorsal lamina narrow, not reaching the base, 3–5 cells wide; costa strong, ending well below the apex; apical lamina about 3 cells wide; median cells irregularly short-rectangular, 7 x 8–18 μ, smaller at the margin; cells at lower part of vaginant lamina 10–12 x 16–32 μ. Monoicous or pseudo-dioicous; ♂ buds attached to the ♀ plants by rhizoids or separated; antheridium single; sporophyte terminal; seta relatively stout, reaching 2 mm.; capsule oblong-ovoid, erect and symmetric, urn about 0.4 mm. long; operculum conic-rostrate; calyptra covering the beak only; exothecial cells strongly collenchymatous; divisions of peristome teeth rough, spirally thickened; spores 8–12 μ.
Type locality, along Anderson's and Nagle's brooks on rocks, Palisades, Closter, New Jersey (Austin).

ILLUSTRATIONS:—Sull. Icones Musc. Suppl. *pl. 29; Pl. 9A.*
EXSICCATI:—Aust. Musc. Appal. Suppl. 479.
In brown patches in crevices of decomposing rocks.
Very rare or overlooked because of almost microscopic size. Also from Tiverton, Rhode Island, Mrs. Handy.

16. FISSIDENS PAUPERCULUS M. A. Howe, Erythea **2**: 97. *pl. 1.* 1894.

Plants minute, loosely gregarious; stems decumbent or ascending, 1.5–2 mm. long in fertile plants; leaves 3–5 pairs, small below, increasing in size upwards; upper oblong to obliquely spatulate, upper and perichaetial nearly or quite 1 mm. long, *acute to short-acuminate, subentire to irregularly crenulate above with projecting cell angles; border lacking; costa stout, vanishing well below apex;* vaginant laminae unequal, ⅛–½ the length of the leaf; dorsal lamina not reaching the leaf base in the upper leaves; upper leaf cells irregularly hexagonal, smaller and rounded toward the margin, larger and oblong-rectangular near the costa, marginal row 7–10 μ in diameter, others 9–16 x 16–40 μ; cells of the vaginant lamina narrower and longer along the margin near the base. Dioicous; seta flexuous, pale, 3–5 mm. long; capsule ovoid to oblong-ovoid, inclined to cernuous, slightly arcuate when dry, urn 0.5 mm. long; operculum conic-rostellate, nearly equaling the urn in length; exothecial cells oblong-rectangular, somewhat collenchymatous, shorter near the capsule mouth; peristome normal, prongs spirally thickened; annulus pale, of 2–3 rows of cells; spores 10–14 μ, mature in spring.
Type locality, Mill Valley, Marin Co., California (Howe), on soil of moist banks with *F. limbatus.* Apparently not collected since. Type seen and original description adapted. *Pl. 9C.*

17. FISSIDENS SUBCRENATUS Schimp., C. Muell. Syn. **2**: 531. 1851.

Fissidens pyrenocystis Card. Rev. Bryol. **37**: 121. 1910.

Plants small, fertile reaching 5 mm. in height with 5–8 pairs of leaves, the lowest much smaller; the upper narrowly oblong-lanceolate, obtusely acute, not margined, reaching 1.5 mm. in length; vaginant laminae about ½ the length of the leaf, unequal, one side rounded to the costa, the other continuous with the apical lamina; costa strong, mostly not quite percurrent, ending 2–3 cells below the apex; upper median leaf cells irregularly hexagonal, 15–25 μ in longest dimension, smaller near the margin, basal cells of vaginant lamina somewhat elongated; all smooth, somewhat bulging, many with a central oil drop that simulates the appearance of a papilla in surface view; vaginant laminae of inner perichaetial leaves abruptly expanded into a sheathing base, a few cells at basal margin somewhat elongated and narrower. Rhizautoicous; anteridia few on small basal plants; seta slender, about 3–5 mm. long, often bent at base when young; capsule erect and symmetric, oblong-cylindric, reaching 1 mm. in length, contracted under the mouth when dry; operculum rostrate, fully as long as the urn; exothecial cells bulging, strongly collenchymatous, rounded-subquadrate, ± 30 μ in width; calyptra covering the operculum only; peristome teeth from a short basal membrane, prongs spirally thickened and papillose.

Type locality, Mirador, Mexico (Liebmann, 1843). *Pl. 12B.*

Cardot's *F. pyrenocystis* from Jalapa, State of Vera Cruz, 4500 ft., on clay (Barnes and Land, 1908), also collected by R. M. Harper "moist clayey soil south side of ravine near Kinderlon, Lowndes Co.," Georgia, Sept. 11, 1902, no. 1615b.

Through the courtesy of the New York Botanical Garden portions of the types of both *F. subcrenatus* and *F. pyrenocystis* have been examined and there seems no doubt of the identity of the plants of the three collections. It is rather surprising that a plant of such wide distribution has been so little collected.

It is nearest *F. pauperculus*, from which it differs in the larger size, narrower leaves and more nearly percurrent costa. Its size also distinguishes it from *F. closteri.*

18. FISSIDENS DONNELLII Aust. Bot. Gaz. **4**: 151. 1879.

Fissidens tenerrimus C. Muell. Act. Soc. Fenn. **19**: 10. 1891.
Fissidens crenato-serrulatus Card. Rev. Bryol. **36**: 70. 1909.

Plants minute, 2–3 mm. high, decumbent, rather scattered, not branched; sterile stems with 6–7 pairs of leaves, fertile with a little less, leaves crowded, overlapping, narrowly oblong; perichaetial reaching 1.5 mm., those next below about 1 mm. long, obtuse to subacute; *margins crenulate-serrate with projecting cells, not bordered;* vaginant laminae rather more than ½ the length of the leaf; *costa ending well below the apex*, in cross section with 3 large central ducts and 2 narrow stereid bands; cells irregularly hexagonal, 7–12 μ in diameter, nearly isodiametric, *sharply mamillose, each cell with a single large papilla* on each side except on the inner surface of the vaginant laminae. Autoicous, antheridia terminal on small basal plants, usually few and mixed with archegonia; sporophyte terminal; seta 2–4 mm. long, bent at base; capsule erect and symmetric, urn 0.7–0.8 mm. long; operculum about the same length, conic-rostrate; calyptra short, covering only the beak; exothecial cells oblong-rectangular, strongly collenchymatous, smaller and subquadrate in several rows below the mouth; peristome teeth spreading when dry, strongly incurved when moist, divisions spirally thickened; stomata in the short neck, few and large; spores 13–21 μ, in summer.

Type locality, on base of cypress trees, Caloosa, Florida (John Donnell Smith & C. F. Austin, 1878).

ILLUSTRATIONS:—Bull. N. Y. Bot. Garden **20**: *pl. 233.* 1919; *Pl. 10.*
EXSICCATI:—Holz. Musc. Acro. Bor. Am. 465, on base of cypress trunks, Sanford, Florida (Rapp). Also collected on limestone, Warwick Hammock, Coconut Grove near Miami, Florida, April 5, 1931 (J. B. McFarlin & A. J. Grout).

The specimens from Coconut Grove on limestone have smaller leaf cells (few larger than about 8 μ) than the Sanford plants, but otherwise are indistinguishable. Mrs. Britton, Bull. N. Y. Bot. Garden **20**: 138–142, has numerous interesting notes on this species.

19. FISSIDENS TAXIFOLIUS Hedw. Sp. Musc. 135. *pl. 39, figs. 1–5.* 1801.

Plants light green, darker with age, 5–20 mm. high; stems rather stout, sparingly branched from the base; leaves close, overlapping, in many pairs, oblong-cultriform, largest in the middle of the stem, ± 2

mm. long, rounded-obtuse and apiculate to subacute, *finely and evenly crenulate above with projecting cell angles;* vaginant laminae ½–⅔ the length of the leaf; dorsal lamina ending abruptly, usually reaching the stem; *costa strong, in well developed mature plants excurrent into a short mucro,* in lower leaves and on depauperate or undeveloped plants *often merely percurrent;* perichaetial leaves above the vaginant lamina narrow, linear or sword-shaped; upper median cells 7–10 μ, bulging-mamillose, smaller and often somewhat lighter colored at the margins, larger near the costa; perichaetial leaves often with terminal and dorsal lamina narrow, almost lacking; ♂ buds on short branches rooting at base. Sporophyte axillary near the base; seta 8–15 mm. long, ascending, flexuous; capsule oblong, contracted under the mouth when dry, urn ± 1.5 mm. long, somewhat inclined to nearly pendulous, mostly somewhat curved and unsymmetric; calyptra covering nearly ½ the urn, split on one side; exothecial cells oblong to subquadrate, incrassate, with many rows of smaller very incrassate isodiametric cells below the mouth; operculum conic, long and obliquely rostrate, beak fully the length of the urn; peristome teeth deep red, the divisions strongly nodulose and marked with very fine oblique lines between the nodes; spores 15–20 μ, mature Nov. to March.

Type locality, European.

ILLUSTRATIONS:—Bry. Eur. *pl. 104;* Hedw. l. c.; Braithw. Brit. Moss Fl. **1**: *pl. 12A;* Jennings, Mosses W. Pa. *pl. 11;* M. H. M. *f. 26; Pl. 10.*

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 83, (Ed. 2) 106; Aust. Musc. Appal. 107; Holz. Musc. Acro. Bor. Am. 177, 467; Grout, Musci Perf. 173.

On damp shaded soil, Canada and the eastern U. S., south to central Florida and Missouri. Common.

Young sterile shoots sometimes approach *F. osmundioides* in leaf characters, but in that species the costa in most instances ends several cells below the apex.

From all forms of *F. cristatus* and *F. adiantoides* it is easily separated by the evenly crenulate upper margin scarcely lighter in color.

Some European plants (e.g. Cardot, Musc. Eur. 116) have the costa much more strongly excurrent than in most American plants, but specimens from Sweden, com. Möller, match the American plants almost perfectly.

20. FISSIDENS BUSHII Card. & Thér. Bot. Gaz. **37**: 365. 1904.

Fissidens subbasilaris var. *Bushii* Card. & Thér. Bot. Gaz. **30**: 16. 1900.

Plants smaller than *F. cristatus;* leaves oblong, rounded-obtuse and apiculate to broadly acute, *finely and evenly crenulate-serrate, without lighter border; costa nearly or quite percurrent;* upper median leaf cells 7–10 μ in diameter. *Sporophyte lateral from near the base of the plant;* seta 6 mm. or more long; capsule ovoid, urn about 1.2 mm. long, operculum rostrate, a little shorter; divisions of the peristome teeth appendiculate. Description based on a type duplicate from Eagle Rock, Missouri, com. M. Thériot. *Pl. 12C.*

Distinguished from small forms of *F. taxifolius* by the more slender costa, barely or not quite percurrent; from *F. subbasilaris* by the evenly crenulate margin, percurrent costa, pellucid and of linear cells; from *F. osmundioides* by the smaller leaf cells and lateral sporophyte. It is nearest to *F. cristatus winonensis* but distinguished by the entire lack of lighter border and finely and regularly crenulate upper margin.

Owen Sound, Ontario, (Macoun, Can. Musci 767, 768); several localities in N. Carolina; near Easton, Pa. (Small); Thomasville, Georgia, Holz. Musc. Acro. Bor. Am. 136 (as *F. polypodioides*); Vt. (Miss Lena Henderson).

21. FISSIDENS OSMUNDIOIDES Hedw. Sp. Musc. 153. *pl. 40, figs. 7–11.* 1801.

Plants of medium size, 1–3 (rarely 8–10) cm. high, in rather close mats, more or less tufted together at base by brown rhizoids, olive to dark green; stems erect, simple or sparingly branched; leaves numerous, close and slightly overlapping, the upper often larger, cultriform to lingulate or oblong-lanceolate, *rounded-obtuse and often apiculate to* broadly acute, 1–2 x 9.5 mm., *finely and evenly crenulate above with projecting cell angles, without border,* vaginant laminae ½–⅔ the length of the leaf, unequal, narrowed in upper and perichaetial leaves to meet the apical lamina; *costa ending a little below the apex;* dorsal lamina usually ending abruptly at the nondecurrent base; upper median leaf cells irregularly hexagonal, bulging, *12–20 μ, marginal, smaller.* Dioicous; sporophyte terminal; seta 5–10 mm. long; capsule erect and symmetric, chestnut-brown, oblong-obovoid; urn reaching 1.8 mm. in length; operculum needle-beaked, nearly as long as the urn; exothecial cells irregular and very incrassate; calyptra many-lobed at base; divisions of the peristome teeth not spirally thickened but nodulose and marked with very fine longitudinal lines between the nodes; spores 18–25 μ, finely papillose, mature summer to autumn.

Type locality, European.

ILLUSTRATIONS:—Bry. Eur. *pl. 103;* Braithw. Brit. Moss. Fl. 1: *pl. 11A;* M. H. M. *f. 25:* Hedw. l. c.
EXSICCATI:—Drumm. Musc. Am. 112; Sull. Musc. Allegh. 179; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 86, (Ed. 2) 109; Aust. Musc. Appal. 104; Grout, Musci Perf. 190; Holz. Musc. Acro. Bor. Am. 35; Macoun, Can. Mosses 63 (as var. *canadensis* Kindb.).

On moist shaded soil, widely distributed in eastern N. America and apparently common in the cooler portions; Yukon to Newfoundland and northward, south to Vancouver Id., Idaho, Missouri, Ohio, North Carolina and Tennessee. Spores from Cape Breton were ripe in July, while in Ontario they were ripe in November.

22. FISSIDENS ORCUTTI n. sp.

Plantae humiles in densis et tenuibus caespitibus degentes; caulis 1.5–2 mm. altus; folia 6–11 juga, inferiora minima; superiora majora, conferta, 0.8–1.25 mm. longa, oblongo-lanceolata, acuta vel apiculata, emarginata, toto ambitu crenulo-serulata; duplicatura ad medium producta, inaequalis, superne angustata in foliis superioribus et perichaetialis; lamina dorsalis ad basin sensim evanida; costa flexuosa, percurrente; cellulis 7–12 μ latis, ad marginem minoribus. Flores dioici, terminales; capsula in pedicello 3–3.5 mm. longo, obovata, 0.5 mm. longa, aequalis; operculo conico-rostrato.

Plants small, in thin close wide mats over clay soil, 1–5–2 mm. high; leaves 6–11 pairs, smaller at base of stem and spaced; the upper overlapping, reaching 1.25 mm. long, oblong-lanceolate, acute to apiculate, not bordered, crenulate along the entire margin by projecting cell angles; dorsal lamina gradually very attenuate, usually reaching the stem; vaginant laminae unequal, about ½ the length of the leaf in the upper and perichaetial leaves, and narrowed at the junction with the wider apical lamina, giving the leaves a characteristic incurved outline on the ventral margin; costa strong, flexuous, percurrent, subexcurrent in the apiculate leaves; upper leaf cells irregularly hexagonal, 7–12 μ in longest dimension, smaller at the margin, larger near the costa, somewhat bulging; basal cells of vaginant lamina somewhat larger. Dioicous; male plants smaller, with 2–3 pairs of leaves; seta terminal, over 3 mm. long, apparently flexuous but immature; capsule immature but apparently erect and symmetric, obovoid, about 0.5 mm. long; operculum conic-rostrate; exothecial cells quadrate to short-rectangular, collenchymatous and rounded at the corners; spores in winter. Type from near New Orleans, Louisiana, Feb. 3, 1927 (Orcutt), com. Bartram. Type in herb. Bartram. *Pl. 13B.*

Differs from *F. osmundioides* in smaller size, narrower leaves and attenuate dorsal lamina and percurrent costa.

23. FISSIDENS SUBBASILARIS Hedw. Sp. Musc. 155. *pl. 39, figs. 6–9.* 1801.

Plants small, 5–10 mm. high, scattered to closely gregarious, erect or ascending; stems simple or branching, leaves 10–18 pairs, somewhat crispate when dry, close and overlapping, oblong, obtuse, or subacute and apiculate by a projecting cell, those in the middle of the stem usually the largest, reaching 1–1.5 mm. in length, *minutely and evenly crenulate below by projecting cell angles, minutely and irregularly serrulate above by larger cells; border none;* vaginant lamina reaching about ½ the length of the leaf; dorsal lamina usually ending abruptly before or after reaching the stem; *leaf cells rather obscure, 7–10 μ in the upper middle of the leaf, strongly and bluntly mamillose both sides,* irregularly rounded-hexagonal, incrassate, larger and less obscure in the base of the vaginant lamina; costa strong, *covered and obscured with mamillose cells in the upper part,* ending several cells below the apex. Dioicous; sporophyte arising from a leaf axil near base of stem; seta 3–5 mm. long, reaching about to the top of the stem; capsule oblong-cylindric, erect and symmetric or slightly curved, brown, urn rather more than 1 mm. long; exothecial cells scarcely collenchymatous; operculum conic-rostrate, about ½ the length of the urn; peristome teeth nodulose above, not spirally thickened or papillose; spores 16–18 μ in diameter, mature in autumn.

Type locality, near Lancaster, Pennsylvania (Muhlenberg).

ILLUSTRATIONS:—Hedw. l. c.; Sull. Icones Musc. *pl. 26;* Jennings, Mosses W. Pa. *pl. 12;* M. H. M. *f, 27; Pl. 7C.*
EXSICCATI:—Drumm. Musc. Am. 111, S. States 42; Sull. Musc. Allegh. 184; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 84, (Ed. 2) 107; Aust. Musc. Appal. 105; Holz. Musc. Acro. Bor. Am. 466; Grout, Musci Perf. 285; Small, Mosses of Southern U. S. 16 (as *F. decipiens*).

On soil, stones and base of trees; Ontario and Connecticut, southward to the Gulf east of the Mississippi. Common on bases of trees in Florida but fruiting sparingly.

Sterile it might be confused with *F. Donnellii,* but in that species the mamillae are more like large papillae, the leaves are finely and evenly crenulate to the very apex and the dorsal lamina ends less abruptly. *F. cristatus* has the costa plainly percurrent and of elongated cells at the apex, and in most cases the lighter border is very apparent.

24. FISSIDENS ADIANTOIDES Hedw. Sp. Musc. 157. 1801.

Typically larger than the next with border less distinct to lacking; *upper median leaf cells 15 μ or larger;* often difficult to distinguish.

ILLUSTRATIONS:—Bry. Eur. *pl. 105* and M. H. M. *pl. 9;* Braithw. Brit. Moss Fl. **2:** *pl. 12B.*
EXSICCATI:—Aust. Musc. Appal. 106; Grout, Musci Perfec. 124.
In much the same habitats as the next; Cape Breton Id. to Vancouver Id., south to California and Florida (including the var. *semicristatus*).
Size is no decisive distinction between this and the next, neither is the inflorescence, as each may be either monoicous or dioicous. Both species vary greatly in height and width of fronds. The size of the leaf cells seems the only reliable distinction and there are many intermediate forms. Forms without perceptible border have been called var. *immarginatus* by Barnes (Bot. Gaz. **12:** 27. 1887).

24a. Var. SEMICRISTATUS **n. var.**

Plantae largiores; folia elimbata; cellulae folii 10–12 μ, quandoque 15 μ.
Plants of a large size, leaf cells intermediate between this and the next, 10–12 μ, occasionally reaching 15 μ; leaf border scarcely visible. Type from near Lake Worth, Florida, March 23, 1934 (A. J. G.).

Also collected by Small (no. 7209) in Dade Co. and Lee Co. (7263). Apparently common in southern Florida. Similar forms of a lesser size are found farther north.
The full description is given of the next because it is very common.

25. FISSIDENS CRISTATUS Wils. Kew Jour. Bot. 9: 294. 1857.

Fissidens decipiens DeNot., in Piccone Elench. Musch. lig. no. 181. 1863.
Skitophyllum marginatum La Pyl. var. β. of *F. adiantoides* Desv. Jour. Bot. 4: 163. 1814.
Fissidens dubius P. B. Prod. 57. 1805.?
Fissidens rupestris Wils. Musc. Brit. no. 31; Jaeger, Enum. Fiss. 25. 1879.
Fissidens floridanus Lesq. & James, Proc. Am. Acad. **14:** 137. 1869.

Plants in rather close dark green sods 1–3 cm. high; leaves numerous, overlapping, oblong-lingulate to oblong-lanceolate, 1.5–2.5 mm. long, acute to rounded and subapiculate, *bordered by a band of lighter colored cells, irregularly crenulate-serrate above;* vaginant lamina about ½ the length of the leaf; costa percurrent or nearly so; leaf cells irregularly hexagonal, bulging-mamillose, 6–10 μ, a few 12 μ, bistratose in places. Dioicous; sporophyte lateral; perichaetial leaves broadly ovate with a very small and narrow dorsal and apical lamina: seta 1–4 mm.; capsule inclined to horizontal, oblong, narrowed to the seta, urn 1–1.5 mm. long; operculum long-rostrate, nearly as long as the urn; exothecial cells incrassate, oblong to quadrate or hexagonal; divisions of peristome teeth strongly trabeculate with fine longitudinal and oblique lines between the nodes below, appendiculate and finely papillose at the top; spores 10–15 μ, mature late autumn to winter.
Type locality, Khasia Mts. India.

ILLUSTRATIONS:—Braithw. Brit. Moss Fl. **1:** *pl. 11D;* Jennings, Mosses Western Pa. *pl. 11; Pl. 6.*
EXSICCATI:—Drumm. Musc. Am. 110 (as *F. adiantoides*), S. States 41 (as *F. adiantoides marginatus*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 85 (as *F. adiantoides*); Holz. Musc. Acro. Bor. Am. 34, 81, and 391 (as *F. adiantoides*); Grout, Musci. Perf. 6.
On moist shaded soil and stones, occasionally on the base of trees; common. Eastern N. America, Nova Scotia to the Gulf, west to the Rocky Mts. and in all the continents of the Northern Hemisphere.
In this species, and more frequently in the preceding, plants occur with the pale border faint or lacking, but the irregularly crenulate-serrate apex distinguishes both from all but *F. subbasilaris* even when sterile, and that species has the costa ending several cells below the leaf apex and also mamillose roughened on the surface.
In response to an inquiry, Mr. H. N. Dixon states that he thinks there is no doubt that *F. cristatus* Wils. is the same as *F. decipiens* DeNot. and he adds that Fleischer also concurred in this opinion. At my request he examined authentic specimens of *F. floridanus* Lesq. & James (Dr. Garber, no. 39. 1877) in the Kew herbarium and writes me that "It is exactly our *F. decipiens* or *F. cristatus*, a rather small form."
Mrs. Britton (Bryol. 8: 49. 1905) states that *F. dubius* P. B., *Skitophyllum marginatum* La Pyl. and *S. adiantoides marginatus* La Pyl. are all based on the same plants collected in America by Beauvois, but without record of the locality. It is probable that *F. dubius* P. B. is the proper name for this plant, but Dr. Pierre Allorge writes me that the types are not in the Paris Museum.

25a. Var. WINONENSIS (R. & C.) **n. comb.**

Fissidens decipiens winonensis R. & C. Bot. Gaz. **22**: 3. 1896.

"Differs from the type by its smaller size, the smaller and narrower leaves with the pellucid border most often indistinct, and the less opaque areolation."

Type locality, Winona, Minnesota; Holzinger, Mosses of Minnesota, no. 6.

What appears to be a portion of the type collection has been seen. The costa ends a cell or two below the apex. It differs from *F. subbasilaris* in the longer smooth costa; from *F. Bushii* in the irregularly crenulate-serrulate apex. I have it also from Ft. Worth, Texas, and near Columbus, Ohio.

26. FISSIDENS POLYPODIOIDES Hedw. Sp. Musc. 154. 1801.

Plants large, 2–5 cm. long, gregarious, yellowish-green; stems simple or branching from the base, rooting at base only, erect to ascending; leaves numerous, barely overlapping, oblong-lingulate, *rounded-obtuse with a short blunt apiculus, or rarely subacute, entire, about 3 mm. long,* not bordered; vaginant lamina ½ the length of the leaf or more; costa strong, almost percurrent; leaf cells irregularly hexagonal, pellucid, smooth; *upper median 10–15 μ, larger near the costa and much smaller at the margin.* Dioicous; sporophyte from the upper leaf axils, sometimes subterminal; seta about 1 cm. long; capsule elongated-obconic, or subpyriform, contracted under the mouth when dry and empty; operculum rostrate, equaling ½ the length of the urn; annulus large, revoluble; divisions of the peristome teeth nodulose.

Type locality, Jamaica, W. I.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 27; Pl. 11.*

EXSICCATI:—Drumm. Musc. Am. S. States 38; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 87, (Ed. 2) 110.

On moist shaded banks and ledges; Georgia, Alabama, Louisiana, and Florida; Fern, Indiana (Underwood). Mostly sterile in the U. S. but easily recognized by its large size and lingulate entire leaves. Sullivant's figures show the leaves too acute for most of our plants.

27. FISSIDENS HYALINUS Hook. & Wils. Jour. Bot. **3**: 89. *pl. 2.* 1841.

Plants 2–3 mm. high, pale green, hyaline; stems mostly simple; leaves 3–5 pairs, upper much larger, 1–1.5 mm. long, *very thin and soft,* oblong-lanceolate, acute, *entire, ecostate; leaf cells oblong-hexagonal, about 30 x 45–60 μ, very thin-walled, a single row at the margin narrow and elongated.* Dioicous; sporophyte terminal; seta 1–2 mm. long, capsule oblong-ovoid, erect and symmetric, operculate about 1 mm. long, operculum long-rostrate, a little shorter than the urn; calyptra cylindric-conic, covering the beak only; peristome normal; spores 11–15 μ, in autumn.

Type locality, "moist rocky ledges, Bank Lick, near Cincinnati, Ohio (Lea, 1839, station lost).

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 21; Pl. 11.*

EXSICCATI:—Sull. Musc. Allegh. 180.

On soil and ledges in cool shaded ravines; very rare or overlooked; two other localities are near Painesville, Ohio and another at Washington, Pennsylvania.

28. FISSIDENS GRANDIFRONS Brid. Sp. Musc. **1**: 170. 1806.

Plants large, 3–15 cm. long, fronds 3–4 mm. wide, *dark green,* often dark-brown and lime-encrusted below, much divided and branched, especially near the base, *rigid and suberect;* leaves numerous, of equal length, 2–3 mm., *crowded and overlapping, rigid and opaque,* linear-lanceolate, entire, not bordered, narrowly obtuse; vaginant lamina more than ½ the length of the leaf; *leaf cells in one layer at the margin, in several at the costa, irregularly hexagonal, 7–12 μ in diameter;* costa strong, vanishing in the apex. Dioicous; sporophyte lateral from the upper leaf axils, rarely produced; seta up to 1.5 cm. long; capsule erect and symmetric or nearly so, oblong, urn about 1.2 mm. long; operculum conic-rostrate, about 1 mm. long; peristome teeth deeply inserted, the divisions rough; spores 15–24 μ.

ILLUSTRATIONS:—Bry. Eur. *pl. 106;* M. H. M. *f. 28.*

EXSICCATI:—Sull. Musc. Allegh. 186; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 88, (Ed. 2) 111; Aust. Musc. Appal. Suppl. 483; Holz. Musc. Acro. Bor. Am. 135.

On wet rocks with trickling water or submerged in streams in limestone regions; southern Canada, Alberta to Ontario, Washington to California, east to New York, West Virginia and Tennessee. Apparently frequent but local.

29. FISSIDENS JULIANUS (Mont.) Schimp. Flora **21**: 271. 1838.

Skitophyllum fontanum LaPyl. Journ. Bot. Desv. **4**: 158. *pl. 34, f. 2.* 1814.
Fissidens debilis Schwaegr. Suppl. 1[2]: 11. 1816.
Fontinalis Juliana Mont. Anal. Soc. Nat. **8**: 246. *pl. 4.* 1837.
Octodiceras fontanum Lindb. Bidrag. Moss. Synom. 23. 1863.
(not *Fissidens fontanus* of Schimp. 1878).

Plants long slender and floating, habit of Fontinalis, 5–15 cm. long, flaccid, blackish-green below; stems filiform, branching by innovations along the whole length; leaves distant, spreading, numerous, linear-lanceolate, entire, without border, obtusely-acute, reaching 3–6 mm. in length; vaginant lamina about ⅓–¼ the length of the leaf; dorsal lamina usually not reaching the base; costa vanishing some distance below the apex; upper median leaf cells irregularly hexagonal, inclining to quadrate below, 14–24 μ in longest dimension, larger near the costa, much smaller at the margins, thin-walled. Monoicous, ♂ and ♀ inflorescences terminating short axillary branches; *seta shorter than* the capsule; capsule elliptic, urn about 0.5 mm.; operculum fully as long as the urn, conic-rostrate; *peristome teeth truncate, irregularly cleft and perforate above,* papillose; spores 18–21 μ, mature in summer.

Type locality, European.

ILLUSTRATIONS:—Bry. Eur. *pl. 108;* Limpr. Laubm. 1: *f. 145;* M. H. M. *pl. 10.*

EXSICCATI:—Drumm. Musc. Am. S. States (as *F. semicompletus*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 89, (Ed. 2) 112; Aust. Musc. Appal. 187; Holz. Musc. Acro. Bor. Am. 265, 335; R. & C. Musc. Am. Sept. 16b; Bartram, Mosses S. Arizona 11.

Submerged on stones and logs; Washington, Ontario and Vermont; south to California, Arizona and Florida; also in S. America and Europe. Varying in slenderness and in the width and distance apart of the leaves; frequent but fruiting sparingly.

W. H. Emig, Bryol. **21**: 60. *pl. 26,* describes a var. *ohioense,* but in an aquatic moss the differences he notes do not seem worthy of varietal rank or even of special mention.

30. FISSIDENS MANATEENSIS Grout, in Holz. Musc. Acro. Bor. Am. 590. 1926; Bryol. **31**: 30. *pl. 3.* 1928.

Very similar to the last and difficult to distinguish when sterile. Leaves averaging smaller and narrower; dorsal lamina ending less abruptly and usually more nearly reaching the stem; cells just above the vaginant laminae 15–21 μ, irregularly subquadrate to hexagonal. Monoicous; male flowers terminating short axillary branches bearing bract-like leaves; perichaetial leaves longer than those below, several times as long as the capsule and seta; *seta terminal at the end of a main branch, 1–3 mm. long, plainly longer than the capsule,* which is obvoid with a long-conic operculum; *peristome teeth deeply cleft, divisions long, slender, and obliquely striate above;* spores about 15 μ, mature in early spring. Type locality and habitat, attached to a log in a creek near the road from Oneco to Arcadia, Manatee Co., Florida. March 9, 1926. Also, Caloosa, Florida, J. D. Smith 1878 as (*F. Hallianus*).

ILLUSTRATIONS:—Bryol., l. c.; *Pl. 12D & 4A.*

The spores were not ripe in most capsules and in some of the unripe capsules the teeth were not fully developed but they were not truncate and in fully ripened capsules the teeth were perfect. Probably common in peninsular Florida but rarely fruiting and confused with *F. fontanus.*

31. FISSIDENS HALLIANUS (Sull. & Lesq.) Mitt. Jour. Linn. Soc. **21**: 551. 1885.

Conomitrium Hallianum Sull. & Lesq. in Aust. Musc. Appal. 108. 1870.
Octodiceras Hallianum Jaeger & Sauerb. Adumb. 33. 1874.

Much smaller and more slender than the two preceding, 3–4 cm. long; seta several times longer than the capsule; *peristome teeth undivided,* papillose in fine lines.

Type locality, on stems of *Cephalanthus occidentalis* with *F. fontanus* in a sunken hole at Athens, Illionois.

ILLUSTRATIONS:—Sull. Icones Musc. Suppl. *pl. 28; Pl. 10A.*

Habitat same as that of the two preceding; New Jersey, New York, Illinois, Idaho (Leiberg).

J. D. Smith's Florida plants, referred to this species for over fifty years, have well developed forked teeth and belong to *F. manateensis.*

Leiberg's plants from Idaho are sterile; the leaves very narrow, the upper about 0.15 mm. wide and

reaching 3 mm. long; in the larger leaves the vaginant laminae are 1/10 to 1/8 the length of the leaf. They may be a different species.

BRYOXIPHIUM Mitt. Jour. Linn. Soc. **12**: 580. 1869.

Eustichia C. Muell. Syn. **1**: 42. 1849 (in part).

Plants slender, bright to yellowish green, more or less gregarious and silky; stems simple, stiff, radiculose and bulblike at base, central strand present; leaves closely imbricated, distichous, keeled, smooth, with a very narrow dorsal lamina not reaching the base; costa vanishing at or near the apex except in the abruptly long subulate-acuminate perichaetial leaves. Dioicous; seta shorter than the perichaetial leaves; capsule globular to obovate, smooth, peristome and annulus lacking; operculum slightly convex and rostrate; calyptra smooth, covering about 1/3 of the urn, cucullate. Type species, *B. norvegicum*.

BRYOXIPHIUM NORVEGICUM (Brid.) Mitt. l. c.

Phyllogonium Eustichia norvegica Brid. Bryol. Univ. **2**: 674. 1827.
Eustichia norvegica C. Muell. l. c.
Fissidens imbricatus Desv. in Brid. l. c.

Plants 1–2.5 cm. long; leaves of middle stem, lanceolate, serrulate at apex and acute to subulate, reaching 2 mm. long; upper and perichaetial leaves long-subulate-acuminate from an ovate base; dorsal lamina scarcely apparent except on upper and perichaetial leaves. Seta rather thick, about 2 mm. long, capsule obovate, pale yellow, reddish at mouth; operculum attached to the columella and long-persistent.

ILLUSTRATIONS:—Bry. Eur. *pl. 195;* Sull. Mem. Am. Acad. N. S. **3**: *pl. 1;* E. G. Britton, Plant World, **1**: 11. 1897 and Bull. Torr. Club **10**: 100. figs. 1–5. 1883; *Pl. 27*.
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 109; Holz. Musc. Acro. Bor. Am. 10.
On shaded moist, usually vertical, faces of sandstone, Greenland, Minnesota, Wisconsin, Central Ohio, Kentucky, Tennessee and Western Pennsylvania; rare and infrequently fruiting. The leaves are so closely appressed that the whole plant appears as a single smooth shining strand with a tuft of filaments at the summit in the fertile plants.

Family ARCHIDIACEAE.*

By Dr. STANLEY A. CAIN.

Small, perennial, terrestrial mosses growing in meadows and bare places, usually in siliceous sand; branches erect, slender, subapical and flagellate with rudimentary leaves below. Stem leaves small, lanceolate-acuminate, costate, entire or serrate. Perichaetial leaves usually longer and broader than the stem leaves, often subulate by the excurrent costa. Calyptra small, fugacious, rupturing irregularly. Capsule small, spherical with a short, broad seta surrounded by a thick cup-like vaginule, indehiscent, without columella, lid, or stomata, the spore-sac filled with a few very large rounded or polyhedral spores, the largest of any known moss. Monoicous or (in one South American species) dioicous.

1. ARCHIDIUM Brid. Bryol. Univ. **1**: 747. 1827.

Plants perennial, small, 2–20 mm. tall, usually 5–10 mm., branching by subapical innovations, with erect fruiting stems. Branches slender with small, distant, lanceolate-acuminate leaves, sometimes capitate (*Euarchidium*, in North America and Europe). Perichaetial leaves usually longer and broader,

* Grateful acknowledgment is made of the work of Mrs. E. G. Britton (N. Amer. Flora 15[1]: 45–46. 1913), from whose monograph of the Archidiaceae the writer has drawn freely for this revision. The author is especially indebted to Mr. Aaron J. Sharp, The University of Tennessee, for assistance in many ways, and to Dr. A. J. Grout, The Biological Laboratory, Cold Spring Harbor, New York, for writing the Latin diagnosis of Austin's heretofore unpublished species. The *Archidium* materials of the following herbaria were examined by the writer and appreciation is extended to the curators: The Brooklyn Botanic Garden, A. J. Grout, The University of Michigan, The Missouri Botanical Garden, The New York Botanical Garden, The Sullivant Moss Society, The University of Tennessee, and The United States National Herbarium.—

Stanley A. Cain, The University of Tennessee (Contribution No. 9, New Ser.) and The Biological Laboratory, Cold Spring Harbor, June, 1936.

lanceolate-acuminate to ovate-subulate, entire or serrulate. Capsules 1–8, usually not more than 3, terminal or appearing lateral by successive branches, or axillary on a short branch, with a short thick seta surrounded by the vaginule. Spores few, rounded or polyhedral, smooth or finely granular.

Type species: *Archidium alternifolium.*

KEY.

1. Paroicous: antheridia and archegonia in the same cluster but not mixed, antheridia in axils of perichaetial bracts below the archegonia		2.
Autoicous: antheridia and archegonia on the same plant but not in the same cluster		3.
2. Stem leaves 1 : 5; median cells 1 : 4, averaging about 60 μ long	*1.*	*alternifolium.*
Stem leaves 1 : 7–10; median cells 1 : 10–12, reaching 100 μ long	*2.*	*longifolium.*
3. Gonioautoicous: antheridia axillary on a fruiting branch in a bud-like cluster with 3–4 ecostate perigonial leaves		4.
Cladautoicous: antheridia terminal on a special proper branch, perigonial leaves costate		5.
4. Capsule 250–325 μ in diameter, spores 145–175 μ in diameter; stem leaves 1 : 4, mostly about 0.7 mm. long; plants seldom over 10 mm. high	*3.*	*ohioense.*
Capsule 430–540 μ in diameter, spores 180–210 μ in diameter; stem leaves 1 : 7, most about 1.4 mm. long; plants frequently 20 mm. high	*4.*	*floridanum.*
5. Median perichaetial leaf cells 1 : 8–10	*5.*	*Donnellii.*
Median perichaetial leaf cells 1 : 4–5		6.
6. Capsule 360–500 μ in diameter; spores smooth, about 210 μ in diameter	*6.*	*Hallii.*
Capsule not over 360 μ in diameter, usually less; spores granular, 125–140 μ in diameter	*6a.*	*Hallii* var. *minus.*

SPECIAL KEY.

Due to the frequent difficulty attending the observation of the antheridia in *Archidium* and consequently determining whether the plants are paroicous or autoicous (and for the latter whether gonioautoicous or cladautoicous) the following special key is provided which omits these characters:

1. Plants conspicuously capitate (large leaves clustered at the ends of fertile and sterile stems, leaves progressively smaller and more widely spaced below becoming reduced to mere bracts)		2.
Plants not conspicuously capitate		4.
2. Perichaetial leaves not over 1.5 mm. long; spores minutely but completely granulate	*6a.*	*Hallii minus*
Perichaetial leaves reaching 2.0 mm. in length; spores smooth		3.
3. Median perichaetial leaf cells 1 : 8–10	*5.*	*Donnellii.*
Median perichaetial leaf cells 1 : 4–5	*6.*	*Hallii.*
4. Stem leaves 1 : 7 or proportionately longer		5.
Stem leaves 1 : 4–5		6.
5. Perichaetial and stem leaves about the same length	*4.*	*floridanum.*
Perichaetial leaves conspicuously longer than the stem leaves	*2.*	*longifolium.*
6. Stem leaves mostly 0.7 mm. long (occasionally as much as 1.3 mm.), perichaetial leaves reaching 1.5 mm. in length	*3.*	*ohioense.*
Stem leaves commonly reaching 1.5 mm. in length, perichaetial leaves up to 2.5 mm. long	*1.*	*alternifolium.*

1. ARCHIDIUM ALTERNIFOLIUM (Dicks. Hedw.) Schimp. Syn. 28. 1860.

Phascum alternifolium Dicks. Pl. Crypt. Brit. **1**: 1. 1785; Hedw. Sp. Musc. 24. 1801.
Phascum globiferum Bruch, Flora **8**: 281. 1825.
Pleuridium globiferum Brid. Musc. Recent. Suppl. **4**: 10. 1819; Bryol. Univ. **2**: 162. 1827.
Archidium phascoides Brid. Bryol. Univ. **1**: 747. 1827.

Phascum Bruchii Spreng. Syst. **4:** 142. 1827.
Archidium tenerrimum Mitt. Jour. Linn. Soc. **8:** 17. 1864.
Archidium Lescurii Aust. Bull. Torr. Club **6:** 144. 1877.
Archidium Ravenelii Aust. Bull. Torr. Club **6:** 145. 1877.

Plants perennial in close low tufts, yellow-green; stems at first simple, not more than 5 mm. high, later branching from the axils of perichaetial or stem leaves and reaching a length of 10 mm., rarely 15 mm., from which arise the fruiting branches the following year when they have become decumbent and rooting; upper stem leaves clasping, lanceolate, channelled, and subulate, reaching 1.5 mm. (1 : 5) in length, mostly entire, sometimes serrulate, gradually reduced below, becoming bract-like and broader (1 : 2); costa percurrent or slightly excurrent, basal cells rectangular and rather regular, about 18 x 60 μ, sometimes longer, the marginal row sometimes made up of shorter and broader, more regularly rectangular cells; median cells more or less prosenchymatous, about 15 x 60 μ, some lower ones reaching 100 μ (1 : 8) in certain plants; perichaetial leaves much larger reaching 0.6 x 2.6 mm. (1 : 4–5), lanceolate or ovate-lanceolate, entire or slightly serrulate; costa percurrent or moderately excurrent; basal cells more or less rectangular, usually around 80 μ long (1 : 5–6), sometimes reaching 140 μ long; median cells more or less prosenchymatous, usually about 70 μ (1 : 5–7) sometimes reaching 100 μ in length. Paroicous: antheridia and archegonia in the same cluster, but not mixed, the antheridia in the axils of the perichaetial leaves below the archegonia, naked or with 2 small bracts: capsules 1 to 3, globose, sessile, each with a short thick seta surrounded by the cup-shaped vaginule from which it easily separates, large, usually 500–540 μ in diameter, sometimes reaching 575 μ; wall thin, breaking irregularly, cells clear or brown toward the apex of the capsule, more or less isodiametric, irregularly 5- to 6-sided, about 40 μ in diameter; calyptra fugacious, small; spores usually about 24, large, yellow, becoming dark, smooth, irregularly tetrahedral or angled, 150–250 μ, usually about 200 μ in greatest diameter; maturing from fall to spring.

Type locality, wet ground, England.

ILLUSTRATIONS:—Dicks. Pl. Crypt. Brit. *pl. 1, f. 2;* Schwaegr. Suppl. 1[1]: *pl. 10,* 3[1]: *pl. 205;* Bry. Eur. *pl. 8, 637;* A. Gray, Man. (Ed. 2) *pl. 1* (as *A. ohionense*); G. Roth, Aussereur. Laubm. **1:** *pl. 11, f. 3, 7;* Limpr. Laubm. **1:** *f. 58, 55;* Braithw. Brit. Moss Fl. **1:** *pl. 14A;* Dixon & Jam. Handbk. Brit. Mosses (Ed. 3) *pl. 7E; Pl. 14C, Pl. 18A.*

EXSICCATI:—Drumm. Musc. Am. S. States 11 (as *A. phascoides*, type material for *A. tenerrimum* Mitt.), 12 (as *A. phascoides* var. 2); Aust. Musci Appal. Suppl. 454 (as *A. tenerrimum*); Holz. Musci Acro. Bor. Am. 76 (as *A. Ravenelii*), 453.

Terrestrial; old fields, pastures, etc.; Eastern United States, New York to Florida and westward to Louisiana and Texas, also in northern and central Europe.

2. ARCHIDIUM LONGIFOLIUM Lesq. & James, Proc. Am. Acad. **14:** 134. 1879.

Plants comparable to *A. alternifolium*, but the more tenuous stems with longer narrower leaves give this moss a far different aspect. As in the preceding species, not at all capitate, the leaves gradually becoming shorter below; stem leaves up to 1.6 mm. long (1 : 7–10), lanceolate, subulate, progressively shorter and broader below, almost entire; costa excurrent; basal cells more or less rectangular, averaging about 70 μ in length (1 : 7); median cells somewhat flexuous-prosenchymatous, up to 100 μ in length (1 : 10–12); perichaetial leaves lanceolate-subulate, reaching 0.36 x 2.5 mm. (1 : 7), entire. strongly echlorophyllose below; costa frequently long-excurrent; basal cells more or less rectangular, mostly 14 x 70 μ, some reaching 105 μ in length; median cells 9–10 x 100 μ, flexuous-prosenchymatous. Paroicous: the gametangia, capsules, and spores have the same characters as the preceding species.

Type locality, Florida. A. P. Garber, 102. 1878.

ILLUSTRATIONS:—Roth, Aussereur. Laubm. **1:** *pl. 11, f. 11; Pl. 15B.*

EXSICCATI:—Verdoorn, Musci Selecti Crit., Ser. II (1935) 54; Holz. Musci Acro. Bor. Am. 454; R. & C. Musci Am. Sept. 353.

In meadows and siliceous sands, Florida.

3. ARCHIDIUM OHIOENSE Schimp. (Bry. Eur. fasc. 43: Archid. 3; hyponym. 1850) C. Muell. Syn. **2:** 517. 1851.

Plants small, seldom over 5–10 mm. high, branching by subapical innovations, light yellow to dark, moderately or not all capitate; stem leaves lanceolate-subulate, mostly 0.7 mm. long, occasionally 1.3 mm. long (1 : 4), shorter and broader below, becoming greatly reduced, appressed-ascending; costa ending in

the subulate tip or excurrent; margins more or less serrulate; basal cells oblong-rectangular, about 35 μ long (1 : 2–4), marginal cells larger and more regular; median cells rhomboidal, about 50 μ in length (1 : 4), sometimes longer, more narrow, and irregularly shaped, especially above; perichaetial leaves longer and broader, 1–1.5 mm. in length, lanceolate to ovate-lanceolate, acuminate, serrulate, especially above and on the acumination; costa percurrent or shortly excurrent; basal cells oblong-rectangular, 35–40 μ long with a fairly definite border of rectangular cells; median cells more or less rhomboidal, mostly about 55 μ long (1 : 5), reaching 70 μ in length above. Gonioautoicous; antheridia on basal fruiting stems in small axillary buds with 3 or 4 ecostate bracts; perigonial leaves, about 0.3 mm. long (1 : 2); capsules 1 to 8, usually 2 or 3, in axillary buds, spherical, 250–325 μ in diameter, walls thin, cells hexagonal, about 20–30 μ in diameter; spores usually about 24, angular or irregularly tetrahedral, deep yellow or orange when mature, smooth or sometimes faintly granulate, 145–175 μ in diameter, maturing from fall to spring.

Type locality, Harper's Ferry, Virginia.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 7;* Roth, Aussereur. Laubm. **1:** *pl. 11, f. 2; Pl. 15C, 16C.*

EXSICCATI:—Drumm. Musc. Am. S. States 13 (as *A. phascoides* 13, var. 3); Sull. Musci Allegh. 213 (as *A. phascoides*, the type for *A. ohioense*); Sull. & Lesq. Musci Bor. Am. 28, (Ed. 2) 35; Aust. Musci Appal. 44; Holz. Musci Acro. Bor. Am. *2*, 476 (as *A. Donnellii*); Grout, N. Am. Musci Perf. 202.

In fields, meadows, and bare places, Quebec, Minnesota to New York, southward to Florida and westward to Texas.

4. ARCHIDIUM FLORIDANUM Aust. ms., n. sp.

"Stems subflexuous, ¾–1 in. long. Leaves shiny, green, half erect, scarcely changing upon drying, narrowly lanceolate, nearly entire, cells laxish, costa percurrent or excurrent. Male fl. small, axillary, female fl. terminal becoming lateral.—Differs from *A. tenerrimum* chiefly in its axillary male fl., longer stems, lower leaves longer, cells narrower, etc.—Differs from *A. ohioense* in longer stems, more spreading leaves with a lighter less excurrent costa. (Probably not confused with the Ohio plant. C. F. A. Nov. 29, 1878.)" From a manuscript in Austin's herbarium, wherein he proposes the name "Floridanum," which he did not publish. Austin's description was from a collection by J. D. Smith, Indian Pass, Florida, March 4, 1878, which should be designated as the type. An annotation by Mrs. Britton reads, "This looks like *A. ohioense*," April, 1907. The following description from the type material indicates the specific rank of the plant:

Caulis subflexuosus, 1.5–2 cm. longus, non capitatus; folia caulis non conferta, anguste lanceolata, subintegra, ± 1.4 mm. longa (1 : 5–7); cellulis in basi rectangulis, 35–75 μ longis (1 : 2–4); mediis anguste prosenchymatis, 12 x 80 μ (1 : 6–7 vel 1 : 10); folia perichaetialia 1.5 mm. longa (1 : 4); cellulis basilaribus latoribus; mediis 85–100 μ longis (1 : 6–7), anguste rhomboidibus vel prosenchymatis. Flores gonio-autoici; capsulae 2, globosae, 430–540 μ latae, sporis 24, laevibus, flavis, 180–210 μ.

Stems subflexuous, usually about 1.5 cm. long, sometimes 2.0 cm.; not at all capitate, stem leaves not crowded, spreading to ascending, little changed in drying, narrowly lanceolate, channelled, nearly entire, usually about 1.4 mm. long (1 : 5–7); basal cells 35–75 μ long (1 : 2–4), rectangular; median cells narrowly prosenchymatous, 12 x 80 μ (1 : 6–7), some 1 : 10; perichaetial leaves about the same length as the stem leaves, 1.5 mm. long (1 : 4), (short for the genus and without the usual contrast in length between the stem and perichaetial leaves); basal cells shorter, broader, and more regularly rectangular; median cells 85–100 μ long (1 : 6–7), narrowly rhomboidal to prosenchymatous. Gonioautoicous; gametangia as for *A. ohioense* except cells of the perigonial bracts are somewhat larger: capsules usually 2, spherical, 430–540 μ in diameter, wall thin, cells irregularly hexagonal, 20–30 μ in diameter; spores about 24, smooth, yellow, 180–210 μ in greatest diameter. Spores in spring.

Type locality, Indian Pass, Florida.

ILLUSTRATIONS:—*Pl. 15A.*

Sandy soil, known from Indian Pass, Sanford and Caloosa, Florida.

5. ARCHIDIUM DONNELLII Aust. Bull. Torr. Club. **6:** 190. 1877.

Archidium ohioense Donnellii Lesq. & James, Man. 50. 1884.

Plants gregarious in yellowish masses, strongly capitate; stems seldom more than 5 mm. high, branching by subapical innovations; fruiting branches leafless below or with leaves rapidly reduced in size below to mere bracts; stem leaves lanceolate-subulate, broadly lanceolate below, almost entire, frequently about

0.7 mm. long (1 : 4) but reaching 1.5 mm., 1 : 2–3 below; costa percurrent, sometimes short-excurrent; basal cells small, rectangular, 1 : 2–4; median cells narrowly rhomboidal to prosenchymatous, seldom 70 μ long; perichaetial leaves ovate-lanceolate, acuminate, reaching 2.1 mm. in length (1 : 4–5), conspicuously longer than the stem leaves, entire, costa excurrent; basal cells rectangular-oblong to quadrate, short and broad; median cells flexuous-prosenchymatous, 8 x 70 μ (1 : 8–10), reaching 90 μ in length. Cladautoicous: antheridia terminal on a slender branch; perigonial leaves costate: capsule immersed, 250–390 μ in diameter, walls thin, cells hexagonal, 25–35 μ in diameter; spores 12–24, smooth, yellow, heavy-walled, not conspicuously angled, 140–160 μ in greatest diameter, rarely as small as 115 μ or as large as 210 μ, maturing in spring.

Type locality, Hampden Sidney College, Prince Edward Co., Virginia. J. D. Smith, April, 1877.

ILLUSTRATIONS:—Roth, Aussereur. Laubm. 1: *pl. 11, f. 6; Pl. 14A.*
EXSICCATI:—Aust. Musci Appal. Suppl. 455.
Terrestrial, from Maryland to Virginia, South Carolina and Florida.

6. ARCHIDIUM HALLII Aust. Bull. Torr. Club 6: 145. 1877.

Plants gregarious in pale yellow tufts, strongly capitate, leaves longer and crowded at the apex of the stem, not over 5 mm. high with slender subapical branches; stem leaves lanceolate, usually not over 1 mm. long (1 : 3–4), entire, with costa percurrent; lower leaves shorter and broader, ovate-lanceolate, 1 : 2.5; basal cells rectangular, up to 17 x 78 μ but mostly shorter; in the lower leaves, quadrate to rectangular, 35–45 μ in length; median cells rhomboidal to prosenchymatous, 14–70 μ (1 : 5) for upper leaves, becoming about half that size toward the apex of the leaf; smaller in lower leaves, 17 x 35 μ, rhomboidal to oblong-rectangular; perichaetial leaves reaching 2.6 mm. in length (1 : 6) but many are shorter and broader, 0.7 x 2.1 mm.; basal cells rectangular-oblong, echlorophyllose, reaching 17–20 x 110–120 μ, but mostly shorter; median cells irregularly rhomboidal-prosenchymatous, 16 x 80 μ (1 : 5), one collection with cells 26 x 110 μ; upper cells rhomboidal, 50 μ long (1 : 3–4). Cladautoicous as in *A. Donnellii;* capsule terminal or thrust aside by the branches, 360–500 μ in diameter; spores about 30, smooth, yellow, angular, about 210 μ in greatest diameter, maturing in spring.

Type locality, Houston, Texas. E. Hall.

ILLUSTRATIONS:—Roth, Aussereur. Laubm. 1: *pl. 10, f. 1, 2; Pl. 14B.*
Terrestrial, Florida to Texas.

6a. Var. MINUS Ren. & Card. Bot. Gaz. 19: 237. 1894.

Plants minute, only 1–2 mm. high, pale yellowish; stem leaves small, not over 1.0 mm., lanceolate, costa usually ending below the apex; perichaetial leaves not over 1.4 mm. (1 : 4); basal cells rectangular, 26 x 52 μ; median cells rhomboidal-oblong, 50–70 μ long (1 : 3–4), some lower median cells reaching 100 μ. Cladautoicous as in the species; capsules smaller, not over 360 μ; spores about 24, smaller, usually about 125 μ in greatest diameter and not over 140 μ, distinctly and continuously granular, which, together with size, seems to constitute a good diagnostic difference, maturing in the fall.

Type locality, Mandeville, Louisiana. A. B. Langlois, 1892.

ILLUSTRATIONS:—*Pl. 18B.*
Collected on soil only from Tehiffonte and Mandeville, Louisiana.

Family DITRICHACEAE.

Plants gregarious to densely cespitose and matted with radicles; stems often branching by innovations, mostly less than 2 cm. high; leaves various, usually subulate from a broader base, which is often sheathing; costa mostly percurrent to excurrent and forming a large part of the awn, which may be rough or smooth; leaf cells smooth, larger and more elongated at the base, alar cells not enlarged; calyptra beaked, mitrate or cucullate; capsules cleistocarpous or with a dehiscent operculum and peristome (which is typically of 16 slender teeth divided nearly to the base into two filiform divisions, sometimes irregularly divided and perforate) erect and symmetric or inclined and unsymmetric, ovoid, cylindric, pyriform, or with a very long neck; annulus usually present and large.

KEY TO THE GENERA.

1.	Capsule cleistocarpous, dehiscing irregularly and without peristome	2.
	Capsule with operculum and peristome	3.
2.	Capsules ovoid, beaked, immersed	*1. Pleuridium.*
	Capsules pyriform or long-necked, immersed to long-exserted	*2. Bruchia.*
3.	Capsule with a slender neck as long as the urn or much longer	*3. Trematodon.*
	Capsule without obvious neck	4.
4.	Leaves distinctly 2-ranked, with sheathing bases	*4. Distichium.*
	Leaves not 2-ranked	5.
5.	Leaves whitish with a glaucous bloom	*6. Saelania.*
	Leaves without bloom	6.
6.	Capsules strongly sulcate, slightly strumose	*5. Ceratodon.*
	Capsules (except *D. pallidum* and *D. Schimperi*) not sulcate	*7. Ditrichum.*

1. PLEURIDIUM Brid. Musc. Recent. Suppl. 4: 10. 1819.

Plants annual or perennial, usually in low dense light- to yellowish-green sods; stems mostly 5 mm. high or less, simple or branching by innovations; central strand present; leaves spreading, erect or the upper secund, not crisped or contorted when dry, small and distant below, longer and crowded above; upper and perichaetial mucronate to long-subulate from an ovate to lanceolate base, entire or minutely serrulate above; costa broad, poorly defined at base, broad and thick above, nearly or quite filling the subulate apex, often rough on the back, in cross section showing 6–12 large guide cells in a row, bordered above and below with narrow stereid bands. Monoicous; capsules immersed on a very short seta, sometimes appearing lateral because of innovations, ovoid to subglobose, short-apiculate with a rather blunt point; calyptra cucullate in our species (except *P. palustris*), covering scarcely ½ the capsule; cleistocarpous without trace of operculum or peristome; spores finely or coarsely papillose. Type species *P. subulatum* (Hedw.) Lindb. (*P. alternifolium* Brid.). Distinguished from *Bruchia* by the lack of neck to the capsule; from *Archidium* by the smaller, much more numerous spores; from other cleistocarpous mosses by the narrow, non-contorted leaves not papillose except at or near the apex.

KEY.

1.	Calyptra mitrate; immersed stomata in the middle of the capsule wall	*7. palustre.*
	Calyptra cucullate, split almost to the apex; stomata basal	2.
2.	Broad leaf base much less than ½ the length of the upper and perichaetial leaves (*Ravenelii* may be sought here)	3.
	Broad leaf base nearly equal to or longer than the rest of the leaf	5.
3.	Median and upper cells of leaf base rectangular to oblong, 2–4 : 1 (*Bolanderi* may be sought here)	4.
	Median and upper cells of leaf base linear, 5–8 : 1	*2. acuminatum.*
4.	Perichaetial leaves entire at base; awn mostly smooth at back; plants of the Pacific Coast	*3. Bolanderi.*
	Perichaetial leaves more or less serrulate at base; awn rough at back; plants of the eastern U. S.	*1. subulatum.*
5.	Awn of perichaetial leaves much less than ½ their length	*5. Sullivanti.*
	Awn of perichaetial leaves nearly or quite equal to ½ their length	6.
6.	Awn of stem leaves nearly or quite smooth on the back; marginal cells of leaf base not shorter than the median	*4. Ravenelii.*
	Awn rough on the back; marginal cells of leaf base shorter and more distinct than the median	*6. californicum.*

1. PLEURIDIUM SUBULATUM (Hedw.) Lindb. Öfvers. Vet.-Akad. Förh. 408. 1863.

Phascum subulatum Schreb. de Phasco 1770; Hedw. Stirp. Crypt. 1: 93. *pl. 35.* 1787, and Sp. Musc. 19. 1801. (not of Hudson, Fl. Angl. 1762).

Pleuridium alternifolium (Dicks.; Kaulf.) Rabenh. Deutschl. Krypt. 2³: 79. 1848 and Bry. Eur. 1850.; Brid. Musc. Recent. Suppl. 4: 10. 1819.

Plants in close yellow-green sods; stems mostly simple, 2–5 mm. high, in damp places frequently with decumbent innovations up to 1 cm. or more; lower leaves distant, somewhat spreading, lanceolate-subulate 0.5–1.5 mm. long, the upper longer and more crowded; upper and perichaetial leaves long subulate-acuminate from an ovate or lanceolate base about ⅓ the length of the leaf, 3–4 mm. long, erect-spreading to subsecund, with the awn more or less roughened and often serrulate on the edges; costa strong, often filling ⅓ the base and all the apex, in cross section with 6–10 large central guide cells and a narrow band of stereid cells above and below; antheridia in axillary buds or rarely naked in the axils of the upper and perichaetial leaves; cells of the upper base of the perichaetial leaves rectangular to oblong-hexagonal, 6–10 μ wide 3–4 : 1 nearly or quite to the shoulder, narrowed and linear above; occasionally the inner perichaetial leaves have the costa very slender at base. Seta very short, 0.4–1 mm. long; capsules ovoid, about 1 mm. long, abruptly apiculate, with a blunt point, stomatose at base; calyptra cucullate; spores finely and densely papillose, reaching 28 μ, mature in late spring to early summer.

Type locality, Saxony.

ILLUSTRATIONS:—Bry. Eur. *pl. 10;* Braithw. Brit. Moss Fl. **1:** *pl. 14A;* M. H. M. *f. 32;* Mosses with a Hand-lens (Ed. 3) *pl. 18c; Pl. 13 C, f, 1, 2.*

EXSICCATI:—So far as examined all the American exsiccati issued as this and the next, except as cited under the next species, are *P. subulatum* (Hedw.) Lindb. [*P. alternifolium* (Kaulf.) Rabenh.]. In many cases careful search has failed to detect antheridia in axillary buds or naked in the leaf axils. Lacking antheridial buds the surest means of identification of this species are the broader and shorter leaf cells of the perichaetial leaves and the much more frequent innovations from the upper leaf axils.

2. PLEURIDIUM ACUMINATUM Lindb. Öfvers. Vet.-Akad. Förh. **1863:** 406. 1863.

Pleuridium subulatum (Huds.) Rabenh. Deutschl. Krypt-Fl. 2[3]: 79. 1848; not *Phascum subulatum* of Schreb. 1770 or Hedw. 1787 and 1801.

Differs from the preceding in the usually shorter plants, the lack of slender innovations, the leaf base longer and more gradually narrowed to the subulate awn, the narrower (few over 7 μ wide) and longer (up to 75 μ) cells of the upper median portion of the base of the perichaetial leaves, and the less roughened awn. Spores mature March to April.

Type locality, England.

ILLUSTRATIONS:—Bry. Eur. *pl. 9;* Braithw. l. c. *pl. 14C;* M. H. M. *f. 31; Pl. 13C, f. 3, 4.*

EXSICCATI:—Drumm. Musc. Am. S. States 7; Sull. Musc. Allegh. 31b; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 39 in part; Grout, Musci Perf. 25 (the S. Carolina plants only, the original issue is *P. subulatum* (Hedw.) Lindb.

Few of the northern plants studied seemed to be this species and it seems less frequent in North America than the preceding. Sandy fields, Massachusetts to Georgia and Alabama; also in California. A few plants from the northern U. S. and some from the South Atlantic States match the European very closely. The long broad leaf base reminds one of *P. Ravenelii*, but in that species the leaf base is from ½–⅔ the length of the perichaetial leaves, while in *subulatum* it is rarely over ⅓ the length. The base of the perichaetial leaves is sometimes slightly toothed near the base of the awn in both European and American plants, but not so distinctly as in *Ravenelii*.

The confusion in the nomenclature of these two species shows that most authors of the 19th century and earlier did not have a clear idea of their relationship.

3. PLEURIDIUM BOLANDERI C. Muell.; Jaeger, Ber. St. Gall. Nat. Gesell. **1868–1869:** 91. 1869.

Pleuridium stramineum Lesq.; Aust. Bull. Torr. Club. **6:** 142. 1877.
Pleuridium alternifolium Howei R. & C. Rev. Bryol. **20:** 30. 1893.
Pleuridium Bakeri Card. & Thér. Bot. Gaz. **37:** 363. 1904.

Stems simple [rarely with slender innovations (*P. alternifolium Howei*)]; lower leaves lanceolate, small, 0.5–1 mm. long, sometimes obscurely serrulate; upper and perichaetial leaves 2–4 mm. long, erect-spreading, somewhat secund, long subulate-acuminate from an entire lanceolate base less than ½ the length of the leaf; cells of the upper median leaf base oblong to linear, narrower at margin; costa slightly toothed at the apex, broad and ill defined at base, filling nearly the entire upper awn, which is channelled by the incurved margins below, with 9–10 large central guide cells. Antheridia few in small buds in and near the perichaetium; seta 0.4–0.7 mm. long; capsule ovoid, about 1 mm. long; exothecial cells thin-walled, hexagonal, little longer than broad; spores 21–30 μ in diameter, coarsely papillose, mature in early spring.

Type locality, Oakland, California.

ILLUSTRATIONS:—Bot. Gaz. l. c. *pl. 16; Pl. 17B.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 39, in part; Holz. Musc. Acro. Bor. Am. 329; Baker, Pacific Slope Bryophytes 295, 568; (all except the first as *P. Bakeri*).

On soil, California to Washington. Near *P. acuminatum* and perhaps better regarded as a subspecies or variety distinguished by the entire margin and smoother awn of the perichaetial leaves. The upper cells of the leaf base are also relatively broader and shorter as a rule. Occasional plants on a more elevated portion of the substratum will have very short awns, scarcely longer than the leaf base (Mrs. MacFadden, no. 9412 from Calif.), while other plants are quite normal.

4. PLEURIDIUM RAVENELII Aust. Bull. Torr. Club. **6**: 142. 1877.

Stems erect, mostly simple, 1–3 mm. high; leaves loosely incurved when dry, the lower smaller and appressed, the upper and perichaetial 1–2 mm. long, concave, tapering from an ovate-lanceolate base to a subulate, canaliculate awn ± the length of the base; margins incurved, more or less serrulate on the upper blade and the awn; costa broad, poorly defined below, nearly filling the awn, percurrent to excurrent, in cross section with 3–5 large guide cells with narrow stereid bands above and below; median and upper leaf cells of blade narrowly oblong to linear, 7–10 μ wide, 5–7 : 1, not shorter at the margin. Paroicous, antheridia naked in the axils of the upper leaves or with a few small bracts; seta about 0.25 mm.; capsules immersed, ovoid to subspherical, yellowish, shortly and bluntly apiculate, 0.5–0.8 mm. long; spores coarsely papillose, 30–37 μ in diameter, maturing March to June.

Type locality, South Carolina.

ILLUSTRATIONS:—Roth, Aussereur. Laubm. **1**: *pl. 16, f. 2; Pl. 16A.*
EXSICCATI:—Aust. Musc. Appal. Suppl. 457 (type); Holz. Musc. Acro. Bor. Am. 473.

On light sandy soil with little other vegetation; Massachusetts to South Carolina. Apparently rare.

Most likely to be confused with *P. acuminatum* from which it is distinguished by the larger spores and relatively longer and more strongly serrate leaf base. The basal cells are similar in most of our species, large and loosely oblong, at times almost inflated, but above the middle of the leaf base the cells are characteristic.

5. PLEURIDIUM SULLIVANTI Aust. Bull. Torr. Club **6**: 142. 1877.

Phascum nervosum Sull., in Gray, Man (Ed. 2) 616. 1856. Not of Hook. 1820.
Pleuridium nervosum Sull. Icones Musc. 19. *pl. 10.* 1864. Not of Hook. & Wils. 1854.

Plants yellowish-green; stems flexuose-erect, *often with slender julaceous sterile flagella-like branches*, 2–4 mm. high; leaves appressed, imbricate, the upper and perichaetial 1.5–2 mm. long, *ovate to oblong, abruptly long-mucronate with a smooth point shorter than the broad serrate basal portion;* lower leaves much smaller, gradually acuminate; costa in the upper leaves stout, broadest at the base of the awn; cells of the upper leaf blade linear, about 7 μ wide, 5–8 : 1, rather thick-walled, the cells below these larger, looser and thinner-walled. Autoicous; antheridia in buds in the axils of the lower leaves; seta about 0.25 mm. long; capsule ovoid to subglobose, less than 1 mm. long, short-apiculate, immersed, often bright orange; spores coarsely papillose, reaching 30 μ in diameter, mature March–April.

Type locality, Pennsylvania.

ILLUSTRATIONS:—Sull. l. c.; *Pl. 17A.*
EXSICCATI:—Drumm. Musc. Am. S. States 6; Aust. Musc. Appal. Suppl. 458.

On light bare soil, often among stones; Connecticut to Florida; rare. Perhaps the most clearly differentiated of all our species.

6. PLEURIDIUM CALIFORNICUM **n. sp.**

Plantae gregariae, humiles, 1–3 mm. altae; folia superiora et perichaetialia e basi lanceolata sensim in subulam breviorem basi producta; basis superior serrata; costa lata, percurrens vel excurrens; capsula ovata, minus 1 mm. longa; sporis 30–37 μ metientibus.

Plants small, gregarious; stems reaching 2–3 mm. long, often shorter, mostly simple; upper and perichaetial leaves 1–1.5 mm. long, gradually subulate from a lanceolate base; *awn much shorter than the broader basal portion, channelled, serrate and rough on the back;* basal portion serrate above, more or less roughened on the back, margins incurved; costa stout, constituting most of the awn, percurrent to excurrent, poorly defined; leaf cells of the upper blade, rectangular to oblong-linear, indistinct except near the margin, apparently in more than one layer, marginal shorter, about 2 : 1; lower leaves smaller. Seta about 0.5 mm. long; calyptra small, cucullate; capsule ovoid, less than 1 mm. long, with a relatively short stout apiculus; spores 30–37 μ, coarsely papillose, maturing in spring. *Pl. 16B.*

Type locality, foot hills, Altadena, California (C. C. Kingman, March 23, 1911), Holz. Musc. Acro. Bor. Am. 330 (as *P. Bolanderi*). Nearest to *P. Ravenelii* but easily distinct by the characters noted in the key.

7. PLEURIDIUM PALUSTRE (Br. & Sch.) Bry. Eur. fasc. 43. *pl. 10.* 1850.

Phascum palustre Br. & Sch. Mém. Soc. Hist. Nat. Strasb. **2**: 2. *pl. A.* 1835.
Phascum uliginosum Hüben.; Gent., Fl. Nass. 146. 1836.
Astomum palustre Hampe, Flora **20**: 285. 1837.
Bruchia palustris C. Müll. Syn. **1**: 19. 1848.
Sporledera palustris Hampe, Schimp. Coroll. Bry. Eur. 6. 1855.

Stems simple or branching by innovations, 1–2 mm. high, rarely more; upper and perichaetial leaves 2–4 mm. long, long linear-subulate from a broader ovate to lanceolate base; awn rough, channelled, *several times the length of the base;* lower leaves smaller; costa stout, excurrent, in cross section showing 2–6 large guide cells with a few stereid cells above and below; cells of upper and median leaf base rectangular to oblong-hexagonal, 7–15 μ wide, 2–3 : 1, rather thin-walled, narrower at the margin. Paroicous; antheridia in the axils of the upper leaves; seta less than 0.5 mm. long; *calyptra mitrate,* 4–5 lobed, rarely entire; capsule sometimes appearing lateral by reason of innovations, ovoid, reaching 1 mm. in length, *with a relatively long and sharp apiculus; stomata immersed, in the middle or upper capsule wall;* spores finely papillose, reaching 30 μ in diameter; maturing May–June.

Type locality, France.

ILLUSTRATIONS:—Bry. Eur. l. c.; *Pl. 18B.*
EXSICCATI:—Drumm. Musc. Am. S. States 8; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 40; Aust. Musc. Appal. 55; Grout, Musci Perf. 279.
In wet fields and sandy swamps; Massachusetts to Tennessee; also in central Europe; rare.

2. * BRUCHIA Schwaegr. Suppl. **2**[1]: 91. 1824.

Saproma Brid. Bryol. Univ. **1**: 52. 1826.
Sporledera Hampe, Linnaea **11**: 279. 1837.

Protonema mostly persistent; plants gregarious, small but usually fruiting freely; stems short and simple, with a central strand; the crowded leaves at the top of the stems larger than the more distant lower leaves; mostly long-subulate from a broader ovate to lanceolate base, erect to somewhat secund; costa stout, ending below the apex or excurrent into the subulate upper part, in cross section with thick outer cells, stereid cells and a few guide cells; leaf cells smooth or papillose, rectangular at base; perichaetial leaves usually larger and more sheathing. Autoicous or paroicous, occasionally dioicous; antheridia axillary or in basal buds. Seta shorter or occasionally longer than the perichaetial leaves; capsules obovoid to pyriform, indehiscent, sharply pointed above, the upper part often colored, neck with numerous large stomata, shorter than the spore sac; calyptra mitrate, lobed, smooth or papillose, covering ⅓ or more of the capsule; spores spinose to warty, or reticulated to pitted, maturing spring to early summer.

Type species, *B. vogesiaca* Schwaegr.

KEY.

1. Capsules immersed to fully exserted; neck of capsule never much exceeding the length of the rest of the capsule	2.
Capsules long exserted; neck much longer than the rest of the capsule as in *Trematodon;* very rare	12.
2. Calyptra papillose to spinose; seta shorter than the capsule	3.
Calyptra smooth	4.
3. Spores reticulate	*9. Ravenelii.*
Spores pitted	*10. Carolinae.*
4. Stems very short, scarcely longer than the leaves or capsule; seta shorter than the capsule (except forms of *Sullivantii*)	5.
Stems longer; seta mostly longer than the capsule	9.

* Mrs. Britton's Monograph in the North American Flora **15**[1]: 46–51 has been freely consulted and often followed.

5.	Leaves rounded-obtuse, nearly as broad as long; costa slender, ending below the apex; spores pitted	*7. fusca.*
	Leaves subulate above; costa subpercurrent to excurrent	6.
6.	Leaf apex rough; upper cells papillose	*3. Donnellii.*
	Leaf apex nearly or quite smooth, sometimes slightly toothed on the margin; upper cells smooth	7.*
7.	Neck shorter than the rest of the capsule (forms of *brevifolia* may be sought here)	8.
	Neck equal to or longer than the rest of the capsule; spores pitted	*7. brevifolia.*
8.	Perichaetial leaves longer than seta and capsule	*8. Drummondii.*
	Perichaetial leaves shorter than capsule and seta	*1. Sullivanti.*
9.	Leaves short-acuminate	*5. Hallii.*
	Leaves long-subulate	10.
10.	Subulate leaf apex very rough on the back; upper blade cells papillose	*3. Donnellii.*
	Subulate leaf apex smooth, or slightly roughened, or slightly toothed	11.
11.	Neck less than ½ the length of the capsule; spores spinose	*2. flexuosa.*
	Neck reaching ½ the length of the capsule; spores reticulate	*4. texana.*
12.	Known from New Hampshire only	*12. longicollis.*
	Known from California only	*11. Bolanderi.*

1. BRUCHIA SULLIVANTI Aust. Bull. Torr. Club **6**: 143. 1877.

Bruchia flexuosa Sull. in A. Gray, Man. 645 (in part). 1848. (Not *B. flexuosa* C. Muell. 1847.)

Plants usually densely gregarious and freely fruiting; stems very short, or sometimes taller and reaching 2 mm. long; lower leaves of longer stems small and distant, upper crowded, 1–2 mm. long, abruptly subulate-lanceolate from an ovate base; costa strong, broader above, slight-roughened, nearly filling the subulate apex; margins entire or sparingly serrulate; basal cells laxly rectangular, gradually smaller and more irregular upwards, all smooth, in the upper blade short-rectangular to irregularly polygonal, about 8 μ wide, narrower at the margin; perichaetial leaves nearly or quite reaching base of capsule. Autoicous; antheridia in lateral or basal buds. Seta 1–2 mm. long; calyptra nearly or quite smooth; capsule pyriform, 1–1.5 mm. long, brown to yellowish, beak straight, *neck about the length* of *spore sac*, with numerous stomata; *spores densely spinose*, 30–40 μ in diameter, June–July.

Type locality, Closter, New Jersey.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 13; Pl. 19B.*

EXSICCATI:—Drumm. Musc. Am. S. States 14 (as *B. vogesiaca*); Aust. Musc. Appal. 56 (as *B. flexuosa*); Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 41, in part (as *B. flexuosa*); Holz. Musc. Acro. Bor. Am. 1 (as *B. flexuosa*), 52 (as *B. curviseta*), 201 (as *B. Donnellii*).

Moist soil in fields, often among grasses and weeds; Maine to Minnesota, south to the Gulf; our most common species.

* 2. BRUCHIA FLEXUOSA (Sw.) C. Muell. Bot. Zeit. **5**: 99. 1847.

Phascum flexuosum Sw. Adnot. Bot. 75. 1829.
Sporledera Beyrichiana Hampe, Linnaea **11**: 279. 1837.
Bruchia Beyrichiana Sull. Icones Musc. Suppl. 25. *pl. 15.* 1874.
Bruchia brevicollis Lesq. & James, Man. 47. 1884.

Close to the last and intergrading with it. Probably derived from it though described earlier. Differs chiefly in longer stems; smoother leaf awns and shorter capsules with a much shorter neck, about 1–1.2 mm. long. Antheridia in leaf axils without paraphyses, rarely bracted. The leaves are usually entirely smooth with a few serrations at or near apex.

Type locality, Pennsylvania

ILLUSTRATIONS:—Sull. l. c.; *Pl. 19A.*

EXSICCATI:—Drumm. Musc. Am. S. States 14 (in part), 15 (as *B. vogesiaca* var. 2) in part; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 32, 33 (according to Mrs. Britton l. c.); (Ed. 2) 41, 42; R. & C. Musc. Am. Sept. 1, 1b.

Subspecies of the last and with the same habitat and range.

* See also *B. texana.*

To the author it seems that the no. 33 of Sull. & Lesq. is nearer *B. Sullivanti* as placed in the Lesq. & James Manual p. 46 (*B. Sullivanti* var. *nigricans*). The leaves are the leaves of *Sullivanti* but the capsules are those of *flexuosa*. 32 is decidedly nearer *Sullivanti*, differing only in the slightly shorter neck of the capsule. Grout, Musci Perfecti 240 (as *B. texana*) is a similar form having the leaves of *Sullivanti* but with the neck shorter than in the S. & L. 32.

The length of the seta in *flexuosa*, *Sullivantii* and *Donnellii* seems quite variable depending on maturity, moisture and other soil conditions. I doubt very much if *Sullivanti* and *flexuosa* are distinct species. Plants occur with slender smooth leaves and long-necked capsules; others with short, rough-awned leaves have capsules with short necks. The no. 1 of R. & C. seems to me to be typical of *B. Sullivanti* in all its characters. As the type of *B. flexuosa* has not been accessible, Sullivant's figures have been taken as typical.

*3. BRUCHIA DONNELLII Aust. Bull. Torr. Club. **6**: 144. 1877.

Subspecies of *B. Sullivanti* from which it differs in the much rougher and more contorted leaf awn, papillose upper leaf cells; antheridia naked in upper leaf axils; shorter capsule neck, shorter than the rest of the capsule; spores spinose to spinose-reticulate, with spines joined in irregular groups, sometimes forming irregular lines but rarely any closed areolae, maturing Feb.–April.

Type locality, Rosedale, Florida.

ILLUSTRATIONS:—Bull. Torr. Club. **21**: *pl. 214; Pl. 23B, 13C, f. 6.*

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 41, in part (as *B. flexuosa*); Aust. Musc. Appal. Suppl. 464; Holz. Musc. Acro. Bor. Am. 352 (his 201 in my set is a form intermediate between *B. flexuosa* and *B. Sullivanti*). On moist soil, S. Carolina to Florida.

This is quite evidently a derivative of *B. Sullivanti* and grades into it. The seta is not always longer than the perichaetial leaves. The capsule is often not more than 1.25 mm. long.

Typical specimens of species 1–3 are distinct enough. *Sullivanti* has capsules with neck as long as the rest of the capsule excluding beak, leaf awn long and somewhat roughened. *Flexuosa* has a neck about ½ the length of the rest of the capsule and leaf awn smooth except for a few serrations at or near the apex. Both 1 & 2 have smooth leaf cells.

Donnellii has very rough leaf awns with upper cells of leaf papillose, neck shorter than *Sullivanti*, longer than *flexuosa*. Between 1 and 2, and between 2 and 3 are numerous plants intermediate in one or more of the above characters. The fact that various species grow intermingled and that many of the exsiccati are mixed adds to the confusion.

The evolution of the areolae on spores of this genus seems indicated in this species and the next two. In this species the spines on the spores of some plants are in irregular groups, in others these groups form wavy lines occasionally inclosing a space (Bauer, Musci Eur. & Am. 2102). In *B. texana* the areolae are all nearly hexagonal with the inclosing ridges papillose on the edges. In *B. Drummondii* these reticulations reach their highest development with areolae more regularly hexagonal. Spores of nos. 1–5 all seem to have one side almost smooth.

4. BRUCHIA TEXANA Aust. Bull. Torr. Club. **5**: 21. 1874.

Bruchia curviseta Lesq. & James, Man. 47. 1884.

Plants gregarious, varying a great deal in size and length of seta even in the same colony; stems 1–2 mm. high, rarely more; basal leaves smaller, the upper and perichaetial clustered, 1–1.5 mm. long, abruptly and rather broadly subulate from an ovate to lanceolate more or less clasping base, subula of perichaetial leaves mostly shorter than the broad leaf base, sometimes toothed at the apex; *costa very thick and strong, weaker at the base, usually not quite filling the awn, ending below the apex or sometimes percurrent*, occasionally slightly roughened on the back; basal cells oblong, thin walled and lax, 10–15 μ wide, 4–6 : 1, the upper much smaller and shorter, irregular. Paroicous, antheridia in the axils of the upper leaves; seta straight to curved, typically 1–1.5 mm. long and exceeding the perichaetial leaves, but often less than 1 mm. long and shorter than the perichaetial leaves; capsule 1–1.5 mm. long, *bright yellow above when mature, pyriform with a long slender beak, abruptly narrowed to the seta; neck nearly or quite as long as the spore* sac, stomatose, shriveled when dry; *spores reticulate with spinose ridges* and closed areolae, 35–40 μ in diameter, maturing in spring.

Type locality, Houston, Texas (E. Hall); type at the N. Y. Botanical Garden.

ILLUSTRATIONS:—Bull. Torr. Club, **21**: *pl. 213; Pl. 23A, 13C, f. 5.*

EXSICCATI:—Drumm. Musc. Am. S. States 15, in part (as *B. vogesiaca* var. 2); Aust. Musc. Appal. Suppl. 463.

On moist soil; Maryland to Illinois, south to Georgia and Texas.

The relative length of seta and leaves seems to be very inconstant in this and the preceding species. In her notes in the Bull. Torr. Club, l. c., Mrs. Britton keeps *curviseta* separate from *texana*, but in the N.

American Flora **15**[1]: 48. 1913, she gives a description of the type form from Texas without mentioning the differences between this and Austin's 463 which she has previously cited as *B. curviseta.* This latter has a much shorter and more curved seta that does not equal the perichaetial leaves in length. The illustration is a good representation of the type.

5. BRUCHIA HALLII Aust. Bull. Torr. Club **5**: 21. 1874.

Stems 2–3 mm. long, simple, erect; leaves imbricate-appressed when dry, smaller below and rather gradually larger upwards, the perichaetial reaching 1 mm. or more in length, clasping; *all ovate-lanceolate,* the upper relatively broader, *abruptly and shortly acuminate,* entire or nearly so; costa strong, nearly percurrent to very briefly excurrent; basal cells oblong-hexagonal, 7–10 μ wide, 2–4 : 1, narrower at the margins; the upper smaller and more irregular. Paroicous; antheridia in the axils of the upper leaves; seta stout, straight or curved, 1–1.5 mm. long, longer than the perichaetial leaves; capsules light brown, 1–1.5 mm. long, *pyriform with a long beak; neck shorter than the spore sac,* rather gradually narrowed to the seta, shriveled when dry; *spores spinose, large, reaching over 50 μ in the type,* mature in winter.

Type locality, Houston, Texas; type at the New York Botanical Garden.

ILLUSTRATIONS:—Bull. Torr. Club **21**: *pl. 215; Pl. 24A.*

On moist soil. In the herbarium of the New York Botanical Garden is but one specimen other than the type. Evidently rare. Distinguishable even with a hand-lens by reason of the relatively long stems covered with the imbricate leaves, not appearing all bunched at the top as in most species.

6. BRUCHIA BREVIFOLIA Sull. in A. Gray, Man. (Ed. 2) 617. 1856.

Plants small; stems 1–2 mm. high; leaves few, erect or spreading, the upper and perichaetial 1–2 mm. long, from a broad ovate base abruptly narrowed to a rather broad subulate awn ⅛ to ½ the entire length of the leaf; margin entire to subserrulate; *costa very thick, ending in the apex or percurrent;* basal cells oblong-rhomboidal to rectangular, smaller above on the shoulders, irregularly rhombic, about 8 μ wide. Autoicous; *antheridia in basal buds;* seta about 0.5 mm. long; calyptra smooth, covering about ½ the spore sac; capsule relatively large, 1–1.5 mm. long, elongate-pyriform, *bright orange above when mature, apiculate;* neck as long as the spore sac, abruptly narrowed to the seta; *spores pitted, 21–30 μ,* mature in early spring.

Type locality, Louisiana.

ILLUSTRATIONS:—A. Gray, l. c. *pl. 1;* Sull. Icones Musc. *pl. 15; Pl. 20B.*

EXSICCATI:—Drumm. Musc. Am. S. States 15, in part; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 34, (Ed. 2) 44; Grout, Musci Perf. 274.

On moist sandy soil, North Carolina to Texas.

Mrs. Britton describes the spores as pitted; to the author they seem rather to be very finely reticulate with thick smooth ridges and small enclosed spaces.

7. BRUCHIA FUSCA E. G. Britton, Bull. Torr. Club **21**: 361. 1894.

Plants closely gregarious, brown to yellowish, often growing around stones and pebbles; stems short, 1 mm. or less in height, naked at the base; leaves few, 3–6, erect-appressed, 1 mm. or less in length, often reaching the base of the capsule, *broadly ovate, often broader than long, obtuse to broadly acute,* entire or nearly so, the inner concave and clasping; costa wide and strong in the perichaetial leaves, often faint at base, ending below the apex to percurrent, nearly or quite lacking in some of the lowest leaves; basal cells thin-walled, lax, oblong-hexagonal, 7–10 μ wide, 2–3 : 1, narrower on the margins, smaller, irregular and incrassate above. Autoicous; antheridia in basal buds; seta short, 0.25–0.5 mm. long; capsule large, 1–1.5 mm. long, nearly or quite exserted, obovoid-pyriform, abruptly apiculate, opaque; neck usually somewhat less than ½ the capsule length, abrupt to tapering; spores 21–30 μ in diameter, *pitted,* mature in April.

Type locality, sandy soil, Maryland (J. D. Smith). Type at the New York Botanical Garden, seen and studied.

ILLUSTRATIONS:—Bull. Torr. Club **21**: *pl. 216; Pl. 20A.*

Also collected in N. Carolina. A very rare and distinct species, nearest the last and evidently a derivative of it. The capsules in the illustration are very poorly drawn; the capsule walls are dense and opaque; the shape reminds one of a stratosphere balloon.

8. BRUCHIA DRUMMONDII Hampe; Jaeger, Ber. St. Gall. Nat. Gesell. **1868–1869**: 97. 1869.

Bruchia brevipes Sull. in A. Gray, Man. (Ed. 2) 617. 1856. (Not of Hook. 1840.)
Bruchia microcarpa Jaeger, l. c. 98, in part. 1869.

Plants gregarious; stems about 1 mm. high; leaves crowded above; perichaetial leaves 2–3 mm. long, from an ovate or ovate-lanceolate base *abruptly narrowed to a narrow channelled awn three times as long*, which is irregular to serrate on the margin and usually smooth at back, mostly extending beyond the capsule, sometimes not quite as long as seta and capsule; costa not quite filling the lower part of the awn; basal cells rectangular hexagonal, reaching 15 μ or more in width, 3–6 : 1; upper cells of lamina smaller, those near the margin much narrower, all smooth. Autoicous; antheridia in basal buds; *seta very short, 0.3–0.5 mm. long;* calyptra smooth; capsule obovate to short-pyriform, apiculate, truncate at base, *orange above, 1 mm. or more in length;* neck about ⅓ the entire capsule length; *spores 38–45 μ, rarely 55 μ in diameter with beautiful large clear hexagonal reticulations about 8 μ in diameter*, maturing March–April.

Type locality, Louisiana.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 14* (as *B. brevipes*); *Pl. 24B, 13C, f. 7.*
EXSICCATI:—Drumm. Musc. Am. S. States 16, in part (as *B. brevipes*); Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 45; Aust. Musc. Appal. Suppl. 462; Holz. Musc. Acro. Bor. Am. 202.
On sandy ground, Virginia to Georgia, Louisiana and Texas. One of our most clearly differentiated species.

9. BRUCHIA RAVENELII Wils. in A. Gray, Man. (Ed. 2) 617. 1856.

Bruchia Schwaegrichenii Jaeger, Ber. St. Gall. Nat. Gesell. **1868–1869**: 97. 1869, in part.
Bruchia microcarpa Wils.; Jaeger, l. c. 98, in part.

Plants minute; stems less than 1 mm. long, much shorter than the upper leaves, which are 1–2 mm. long, the upper and perichaetial abruptly subulate from an ovate base; costa broad, excurrent into a more or less serrate awn, nearly smooth to spinose-roughened on the back; margins often incurved, more or less serrulate above; basal cells rhomboidal to oblong, mostly 8–10 μ wide, 3–5 : 1, narrower at the margin, much shorter and more irregular on the shoulders; *calyptra bell-shaped, lobed, apiculate and spinose-papillose.* Autoicous, antheridia in basal buds; capsule obovoid-pyriform, nearly or quite 1 mm. long, apiculate, usually not reaching the leaf apices, sometimes emergent when leaves are short, neck mostly shorter than the spore sac; seta much shorter than the capsule; spores pitted when immature, when ripe reticulate with sharp rough edged ridges, with areolae 6–8 μ wide 25–32 μ in diameter, mature in winter.

Type locality, Santee Canal, South Carolina.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 16; Pl. 21A.*
EXSICCATI:—Drumm. Musc. Am. S. States 16, at least in part (as *B. brevifolia*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 33b; Aust. Musc. Appal. Suppl. 460; Holz. Musc. Acro. Bor. Am. 353; Grout, Musci Perf. 228. Austin's 461 contains *B. Drummondii* and mature plants of *Ravenelii* with reticulate spores. In Sull. & Lesq. 33b and Holz. 353 the spores are halfway between pitted and reticulate, probably because of immaturity.
Moist sandy soil; S. Carolina to Louisiana and Florida.

10. BRUCHIA CAROLINAE Aust. Bull. Torr. Club **6**: 144. 1877.

Bruchia Ravenelii mollis Lesq. & James, Man. 49. 1884.
Bruchia Hampeana Lesq. & James l. c.; not of C. Muell. 1849.

Plants averaging smaller than in the last; differing mainly in the spores which are finely pitted when immature as shown in the figure, but which when mature are reticulate with small areolae, 2–3 μ in diameter and bounded by thick smooth ridges. Mature spores of this species and immature spores of the last look somewhat alike except for the difference in the size of the areolae. In the spores of *carolinae* about 8–10 pits or areolae can be seen across the diameter of the spore while in *Ravenelii* only 3–5 are fully in view.

Type locality, S. Carolina.

ILLUSTRATIONS:—Bull. Torr. Club. **21**: *pl. 217; Pl. 21B and 13C, f. 8.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 43 (as *B. Ravenelii*); Grout, Musci. Perf. 229; Verdoorn, Musci Selecti et Critici 6, (as *B. Ravenelii*).
A careful study of the material available shows little constant difference between this species and the last except the spore markings. The spores at the same stage of development are about the same size. The

neck of the capsule is about the length of the spore sac in the type of *Carolinae* and in other specimens examined except Sull. & Lesq. (Ed. 2) 43, in which the capsule shape can not be differentiated from that of *Ravenelii*. In this the spores are fully mature and the pits are almost reticulae with low smooth walls but with as many as ten pits across the spore diameter, which reaches 37 μ. The spores in Grout, Perfecti 229, are immature and smaller and with smaller more shallow pits as in the type. The essential difference between the two species seems to be that the spores of *Ravenelii* when mature are reticulate with lines of irregular height and thickness, the reticulae or spaces larger, 3–5 across the spore diameter. While in *Carolinae* the spores are deeply pitted, the pits with narrow smooth walls, 8–10 reaching across the spore diameter. The leaves of both species vary from an ovate to a lanceolate base, and a rough serrate apex to a nearly smooth entire one.

11. BRUCHIA BOLANDERI Lesq. Mem. Calif. Acad. **1**: 5. 1868.

Plants densely gregarious; stems 1–2 mm. long, simple or branching by basal innovations; leaves crowded, loosely imbricate, small below, gradually increasing in length upwards; lanceolate to laneolate-subulate; costa strong, vanishing in the apex; perichaetial leaves longer, 1–2 mm., flaccid and loosely areolate, clasping, the interior very narrowly lanceolate; leaf cells thin-walled and lax throughout, oblong-hexagonal below, rectangular and 1–3 : 1 above. Autoicous; antheridia in basal buds; seta 2–4 mm. long, straight or flexuose; calyptra small, narrowly conic; capsule 2–3 mm. long, very long-beaked; neck very long, more than equal the rest of the capsule, stomatose; spores finely warty-papillose, 24–27 μ.

Type locality, Westfall's Meadow, alt. 2400 m., near Big Tree Grove, Yosemite Valley, California, the only known locality.

ILLUSTRATIONS:—Sull. Icones Musc. Suppl. *pl. 14; Pl. 22A*.

Mrs. Britton mentions a slight goiter and a differentiated non-deciduous lid on the capsules, neither of which I was able to demonstrate in type specimens. The shape of the capsules is remarkably like that of *Trematodon*. There are a few short cells at the base of the beak but far too high for an operculum.

12. BRUCHIA LONGICOLLIS D. C. Eaton, Bull. Torr. Club **17**: 100. 1890.

Very like the preceding; the perichaetial and upper comal leaves are 2–3 mm. long and broader in the middle; costa stronger; seta 4–5 mm. long; capsule 3–4 mm. long with the beak rather narrower and longer; spores 27–35 μ, rough with relatively large irregular warts; mature in July.

Type locality, Jackson, New Hampshire, on decayed log in swamp. The only known locality. Type at the New York Botanical Garden, seen and studied.

ILLUSTRATIONS:—Eaton, l. c. *pl. 101; Pl. 22B*.

3. TREMATODON Mx. Fl. Bor. Am. **2**: 289. 1803.

Plants gregarious to scattered, growing on soil in moist places; stems mostly simple, with a large central strand; leaves more or less crisped when dry in our species, yellowish-green, with a broad clasping base abruptly or gradually tapering into a lanceolate or subulate apex; costa nearly percurrent to excurrent; leaf cells smooth, thin-walled, loosely elongate-hexagonal to rectangular below, above shorter. Autoicous in our species; seta slender, much exserted, yellow, erect or somewhat curved; capsule with a long slender stomatose neck, often longer than the urn, mostly somewhat curved; operculum long-rostrate, as long as the urn; calyptra cucullate; annulus present; peristome present in our species, united below, the 16 teeth entire, perforate or divided nearly to the base, vertically striate on the outer face.

Type species, *T. ambiguus*.

KEY.

1. Neck about twice the length of the urn; leaf margins more or less revolute along awn; peristome teeth perforate between the nodes ..... *2. longicollis.*
   Neck about the length of the urn ..... 2.
2. Costa filling the awn, margins not revolute; peristome teeth bifid ..... *1. ambiguus.*
   Costa not filling the awn, margins revolute; peristome teeth entire or slightly perforate at apex ..... *3. brevicollis.*

1. TREMATODON AMBIGUUS (Hedw.) Hornsch. Flora **2**: 88. 1918.

Dicranum ambiguum Hedw. Sp. Musc. 150. 1801.
Trematodon acicularis Kindb. Rev. Bryol. **23**: 18. 1896.

Plants gregarious; stems simple or sparingly branched, up to 1 cm. long, erect to ascending, radiculose; leaves abruptly linear-subulate from an ovate or oblong concave sheathing base, 1–2 mm. long, canaliculate above, toothed at extreme apex; costa stout, nearly or quite filling the awn, percurrent; basal leaf cells oblong-hexagonal to rectangular, 10–25 μ wide, 2–5 : 1, thin-walled and pellucid or yellowish, narrower at the margin; shorter and more incrassate above, awn longer than the broad base; perichaetial leaves reaching more than 3 mm. long, awn often shorter than the base. Autoicous; seta bright yellow, 1–3 cm. long; capsule more or less curved, cylindric; urn up to 2 mm. long; neck of equal or greater length, bearing a slight goiter at the base (strumose); operculum long-rostrate, nearly as long as urn; annulus large, revoluble; peristome teeth from a basal, collar-like membrane extending above the capsule mouth, dark red, mostly split nearly to the basal membrane, occasionally perforate between the nodes instead, striate longitudinally on the outer surface, papillose above and on the inside; exothecial cell walls linear-incrassate; spores coarsely rough-warty, about 24 μ in diameter (Limpricht says 24–35 μ), mature in summer.

Type locality, Sweden.

ILLUSTRATIONS:—Bry. Eur. *pl. 96;* M. H. M. *f. 38; Pl. 26B.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 96; Aust. Musc. Appal. Suppl. 475; Macoun, Can. Musci 24; Grout, Musci Perf. 282; Holz. Musc. Acro. Bor. Am. 333.
On soil in old fields and meadows; Newfoundland to Alaska, south to Virginia.

2. TREMATODON LONGICOLLIS Mx. l. c.

Trichodon flexifolius R. & C. Rev. Bryol. **15**: 70. 1888.

Differs from the preceding in the following particulars; the margins of the awn are more or less revolute and the costa does not fill the awn nor extend quite to its apex; the neck of the capsule is fully twice the length of the urn and has a less conspicuous goiter; the peristome teeth are not split but perforate between the nodes in the lower portion; spores mature April–July.

Type locality, sandy places, Carolina.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 19; Pl. 25.*
EXSICCATI:—Drumm. Musc. Am. S. States 55; Sull. Musc. Allegh. 173; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 75, (Ed. 2) 95; Aust. Musc. Appal. Suppl. 476; R. & C. Musc. Am. Sept. 20; Holz. Musc. Acro. Bor. Am. 79; Grout, Musci Perf. 66.
On moist sandy or clayey soil in old fields and ditches; Massachusetts to Florida, Louisiana and Mexico; also in Cuba and Italy. Very common on the sides of drainage ditches in peninuslar Florida.

3. TREMATODON BREVICOLLIS Hornsch. Flora **2**: 88. 1918.

Leaves ovate to ovate-lanceolate, short-acuminate; costa ending in the apex, which is not toothed; perichaetial leaves longer, abruptly short-subulate. Neck of capsule equaling the urn; stomata imperfect; peristome teeth inserted below capsule mouth, perforate only near the apex; spores 45–60 μ in diameter, maturing in late summer.

Type locality, Austria.

ILLUSTRATIONS:—Bry. Eur. *pl. 95; Pl. 26A.*
Known in North America from Greenland only; found also in the alpine regions of Europe and central Asia.

4. DISTICHIUM Bry. Eur. fasc. 29–30. 1846. (*Nomen conservandum.*)

Cynontodium Hedw. Sp. Musc. 57. 1801.
Swartzia Ehrh.; Hedw. Stirp. Crypt. **2**: 72. 1789.

Plants in dense silky matted tufts; stems slender, dichotomously divided, tomentose, with a large central strand and collenchymatous cells; leaves *two-ranked, spreading and abruptly narrowed to a long linear-subulate awn from a concave sheathing oblong* base; costa comprising most of the awn, entire or serrulate at apex, in cross section with median guide cells, two stereid bands and thickened outer cells. Monoicous; seta long, slender, yellow; calyptra cucullate; capsules cylindric to ovoid, erect to horizontal, operculum conic; peristome teeth not confluent at base, deeply inserted, 8 or 16, irregularly split along the middle or variously torn and perforate; annulus narrow, spores rough.

Type species, *D. capillaceum.*

KEY.

1.	Capsule erect, oblong-cylindric and symmetric to ovoid-cylindric	*1. capillaceum.*
	Capsule inclined, ovoid and unsymmetric	2.
2.	Peristome teeth 16, variously perforate and split	*2. inclinatum.*
	Peristome of 8 lobes, made up of 4–6 variously united linear divisions	*3. Hageni.*

1. DISTICHIUM CAPILLACEUM (Hedw.) Bry. Eur. l. c. *pl. 193.* 1846.

Cynontodium capillaceum Hedw. Sp. Musc. 57. 1801.
Swartzia montana [Lam.] Lindb. Musc. Scand. 26. 1879.

Plants in dense tufted silky sods reaching 8 cm. or more in thickness; stems 2–8 cm. long, slender, matted together with brown tomentum, decaying below and growing above, repeatedly dichotomous; leaves 2–4 mm. long, the base sheathing, oblong, 1 mm. or more in length, much shorter than the narrowly linear, spreading, rough-papillose awn; basal cells oblong to linear-flexuose, 3–5 μ wide, those of the upper blade much shorter, irregularly elongated-hexagonal, 2–3 : 1. Seta slender, 0.5–2 cm. long; capsule erect or nearly so, oblong-cylindric, with operculum 1–2 mm. long, brown to chestnut when old; annulus large, falling in pieces; peristome teeth 16, red, slender, irregularly divided, often more or less broken and imperfect, sometimes nearly entire, smooth, relatively short; spores 17–20 μ, papillose, mature in summer.

Type locality, France.

ILLUSTRATIONS:—Bry. Eur. l. c.; Braithw. Brit. Moss Fl. **1:** *pl. 15B;* M. H. M. *f. 34.*

EXSICCATI:—Drumm. Musc. Am. 122, 123; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 108, (Ed. 2) 162; Aust. Musc. Appal. Suppl. 485; Macoun, Can. Musci 57; Holz. Musc. Acro. Bor. Am. 58.

Fissures in rocks in cold and subalpine regions; Greenland to Alaska, south to New England, New York, the Great Lakes region, and in the Rocky Mountains to Arizona. Seemingly abundant in suitable habitats. Closely allied to some species of *Ditrichum* but easily recognized by its distichous sheathing leaves with linear spreading points.

2. DISTICHIUM INCLINATUM (Hedw.) Bry. Eur. l. c.

Cynontodium inclinatum Hedw. Sp. Musc. 58. 1801.
Swartzia inclinata Hedw. Stirp. Crypt. **2:** 74. *pl. 27.* 1788.

Plants in dense olive-green tufts 2–4 cm. high, shorter and less silky than the last; leaves less evidently distichous, closer, 2–3 mm. long, broad base relatively shorter, 1 mm. or less in length, ovate to oblong-ovate, awn less spreading when moist; basal leaf cells narrowly oblong-linear, the uppermost of the blade mostly short-rectangular to subquadrate (oblong in perichaetial leaves), all more incrassate and colored. *Capsule inclined and unsymmetric;* peristome *teeth triangular-lanceolate, variously perforate and split,* usually into 3 divisions, rarely with one or two complete divisions, *striolate transversely to obliquely;* spores 30–45 μ in diameter, warty, mature in summer.

Type locality, Upsala, Sweden.

ILLUSTRATIONS:—Bry. Eur. *pl. 194;* Braithw. l. c. *C;* Limpr. Laubm. **1:** 516. *f. 158; Pl. 18C.*

EXSICCATI:—Drumm. Musc. Am. 124; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 108b, (Ed. 2) 162; Aust. Musc. Appal. Suppl. 486; Macoun, Can. Musci 58; Holz. Musc. Acro. Bor. Am. 178 and 561 (as *D. Hageni* Philib.); Grout, Musci Perf. 253.

In similar situations as the last and in cool peat bogs, less common. Greenland and Labrador, south to the St. Lawrence basin, Minnesota, and the mountains of Montana, Utah and northern California.

Sometimes the plants are a dark red-brown throughout except at the growing tips. Holzinger's 561 is a depauperate, dark colored form stunted by cold and other unfavorable conditions. The peristome is typical and does not in the least resemble that of *D. Hageni.*

3. DISTICHIUM HAGENI Ryan; Philibert, Rev. Bryol. **23:** 36. 1896.

In leaf structure and general appearance almost indistinguishable from *D. inclinatum,* but the 8-lobed peristome, deeply inserted, each lobe or tooth of 4–5 or more irregular linear divisions, irregularly branching and irregularly united at the nodes, is quite distinct. If two teeth of *D. inclinatum* should be connected in pairs by irregular cross attachments it would present a fair picture of a tooth of the peristome of *D. Hageni.*

Through the courtesy of Dr. Johannes Lid of the Oslo Museum I have seen cotypes of *D. Hageni* from Norway. The plants in this are less than 1 cm. high, but specimens from Greenland, also sent by Dr. Lid, are fully 4 cm. high. Besides the above mentioned material Dr. Lid also sent specimens from New Kent, Ellsmere Land, King Oscar Land, and North Lincoln in Arctic America. In the large Greenland plants the awn of the upper and perichaetial leaves is much longer (reaching 2.5 mm.) than the broad body of the leaf. In the smaller plants of the type and in most leaves of the other collections the awn is equal to or shorter than the broader part. The roughness of the awn varies greatly, even on the same plant, from nearly smooth to strongly papillose. The capsules vary from short-ovoid to oblong-ovoid and are often plicate when dry. *Pl. 13C, f. 9.*

A single plant with this peculiar peristome might be regarded as an abnormal form of *D. inclinatum*, but the considerable number of collections in the arctic regions, all showing this same character, indicates that it is fixed and worthy of specific recognition.

Below is a translation of Philibert's original description of the peristome.

The peristome of *D. Hageni* is made up of a membrane which is divided irregularly into 8 lobes separated by a clearly marked interval, each of the lobes shows on its internal face 4–5 rows of segments, elongated and linear, brownish to fulvous. These outline likewise 4-5 branches. These branches are clearly marked and are sometimes free toward the summit, sometimes entirely adherent to the main part of the lobe, sometimes more or less united, 2 by 2, at their nodes. They may even be enveloped by a sort of hyaline network uniting them to each other. The dorsal aspect is much the same.

Brotherus (Laubm. Fennoskand. 17) says "Kapsel . . . länglich-zylindrisch, symmetrisch." This is not true of any plants I have seen.

5. CERATODON Brid. Bryol. Univ. 1: 480. 1826.

Plants cespitose, more or less matted together below, green to brown, often with a reddish tinge when old; stems with central strand, slender, erect, branching by innovations; leaves erect-spreading, crowded, appressed and somewhat contorted when dry; costa strong, nearly percurrent to excurrent, margins recurved; leaf cells smooth, short-rectangular, more or less rounded at the corners, thick-walled; perichaetial leaves sheathing. Mostly dioicous; seta long-exserted; calyptra cucullate; capsule inclined to horizontal and unsymmetric to erect and symmetric, more or less sulcate when dry; annulus of 2–4 rows of cells; operculum conic to rostrate; peristome from a short basal membrane, of 16 teeth, bifid nearly to the base and often brilliantly colored, nodose, papillose above.

Type species, *C. purpureus*.

KEY.

1. Leaves of the sterile shoots elliptical to ovate, obtuse, concave and spoon-shaped; costa not percurrent ..... *4. heterophyllus.*
   Leaves of sterile shoots, with few exceptions, acute with margins strongly revolute to near the apex; costa percurrent to excurrent ..... 2.
2. Capsule inclined to horizontal, deeply sulcate when dry ..... *1. purpureus.*
   Capsule erect to slightly inclined ..... 3.
3. Capsule 2–3 mm. long; costa percurrent or shortly excurrent into a serrate point .... *3. stenocarpus.*
   Capsule 1–2 mm. long; costa mostly excurrent into a considerable slender awn nearly or quite entire ..... *2. conicus.*

1. CERATODON PURPUREUS (Hedw.) Brid. l. c.

Dicranum purpureum Hedw. Sp. Musc. 136. *pl. 36.* 1801.
Dicranum purpurascens Hedw. l. c. 137. *pl. 35.*
Ceratodon Columbiae Kindb. Rev. Bryol. 23: 20. 1896.

Plants in wide close mats, green above when young, brown to reddish when old, perennial, polymorphous, stout and with short crowded leaves in xerophytic and alpine situations, long lax and flexuous in cool shaded moist situations; stems normally 1–2 cm. long, rarely 5 cm. or more, growing by innovations above and dying below; occasional plants bear slender flagellate innovations with much reduced leaves; leaves ovate-lanceolate to narrowly lanceolate, gradually narrowed to an acute or acuminate apex, erect-open when moist, twisted to crispate when dry, carinate, the lower smaller and less crowded, the upper reaching 2 mm. long; *margins reflexed to near the apex, more or less serrate above;* costa strong, percurrent to shortly excurrent; perichaetial leaves sheathing, the outer rather abruptly narrowed to a longer or shorter awn, the inner often very short-acuminate; all leaves without papillae; leaf cells short-rectangular to quadrate

or irregular above, thick-walled, more elongated near the base; cells of the lower base of perichaetial leaves much longer and less incrassate. Seta dark red (yellowish in varieties), often appearing lateral by reason of innovations, 1–2.5 mm. long; capsules oblong to oblong-ovoid, *inclined to horizontal when mature, more or less curved and unsymmetric, slightly strumose, regularly sulcate when dry, 2–2.5 mm. long, dark red-brown;* operculum sharply conic, curved downward; *peristome teeth 16, dark red and trabeculate below, the two filiform divisions of the teeth irregularly joined at the nodes,* the upper portion separate, with few and inconspicuous nodes, finely papillose, often bordered by a paler inner lamella; spores smooth, 10–15 μ in diameter, mature spring to summer.

Type locality, European.

ILLUSTRATIONS:—Hedw. l. c.; Bry. Eur. *pl. 189, 190;* M. H. M. *figs. 36, 37;* Mosses w. H.-lens (Ed. 3) *f. 25.*

EXSICCATI:—Drumm. Musc. Am. 116; Sull. Musc. Allegh. 153; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 107, (Ed. 2) 159, 160; Aust. Musc. Appal. 116, 117 ? ; Holz. Musc. Acro. Bor. Am. 83, 84, 606, 83 (as *C. conicus*); R. & C. Musc. Am. Sept. 19; Allen, Mosses Cascade Mts. 15; Baker, Pacific Coast Bryophytes 595; Grout, Musci Perf. 51.

Cosmopolitan and found in all sorts of habitats and ecological conditions (e.g. on the inside of an unused chimney flue 50 ft. above the ground); fruiting freely. Frequently found on soil recently burned over. Mrs. Britton in the North American Flora **15**[1]: states that over 50 synonyms and many forms have been recorded.

1a. F. BREVIFOLIUS (Milde) E. G. Britton, l. c.

Plants small, stems short, often julaceous or filiform; leaves erect-appressed, ovate, acute. Arctic; Yukon Terr.; McKinley Park, Alaska.

1b. F. ARISTATUS (Aust.) E. G. Britton, l. c.

Plants taller, often paler; seta yellow; leaves acute or acuminate; costa excurrent; xerophytic. (Maine to New Jersey.)

1c. F. XANTHOPUS (Sull.) E. G. Britton, l. c.

As in the last except costa percurrent; operculum sometimes beaked. (Widely distributed, especially in the South and West.) Holz. Musc. Acro. Bor. Am. 154; Baker, Pacific Coast Bryophytes 395; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 107b; Grout, Musci Perf. 280.

2. CERATODON CONICUS (Hampe) Lindb. Musc. Scand. 27. 1879.

Trichostomum conicum Hampe in C. Muell. Syn. **1**: 575. 1849.
Ceratodon minor Aust. Bot. Gaz. **2**: 89. 1877.
Ceratodon purpureus Gräfii Schlieph. in Limpr. Laubm. **1**: 487. 1887.

Plants smaller, less than 1 cm. high; leaves not crisped when dry, much crowded above, ovate-lanceolate, mostly entire; costa excurrent into a linear-subulate smooth awn, rarely toothed, sometimes as long as the rest of the leaf; inner perichaetial leaves obtuse with costa often not reaching the apex; capsule erect or inclined, slightly unsymmetric and strumose.

Type locality, northern Germany.

ILLUSTRATIONS:—Braithw. Brit. Moss Fl. **1**: *pl. 26E;* Limpr. l. c. *f. 153;* Dixon & Jam. Handb. Brit. Mosses (Ed. 3) *pl. 9H; Pl. 18E.*

On soil, bases of stumps, etc. Rare; Minnesota, Idaho, Washington, British Columbia, and Alaska; also in Europe.

Dixon, l. c. regards this as a subspecies as he says he finds all kinds of intergradations. The typical forms like Macoun's specimens from Spence's Bridge, B. C., May 31, 1889 are so distinct as to leave no doubt as to their correct identification.

3. CERATODON STENOCARPUS Bry. Eur. fasc. 29–30. *pl. 191.* 1846.

Ceratodon corsicus Bry. Eur. fasc. 43. 1850.
Ceratodon vulcanicus C. Muell. Bull. Herb. Boiss. **5**: 191. 1897.

Leaves scarcely to be distinguished from those of *C. purpureus*, varying from narrowly lanceolate and entire, to shorter and strongly dentate above, perhaps rather more crispate when dry; perichaetial leaves

longer sheathing, 3–4 mm. long. *Seta pale yellow to orange; capsule erect to inclined, narrowly cylindric, slightly unsymmetric to slightly arcuate, 2–3 mm. long,* plicate when dry and empty, brown, darker with age; *peristome teeth very slender, pale, nearly uniform in color, divisions nearly or quite separate to base, spinose-papillose,* less trabeculate than in *C. purpureus;* spores mature in autumn.

Type locality, Neilgherry Hills, India.

ILLUSTRATIONS:—Bry. Eur. l. c.; *Pl. 16E.*

Discovered on shaded ledges in the upper Sabino Canyon, Mt. Lemon, Santa Catalina Mts., Pima Co. Arizona, alt. 9000 ft. (Bartram, Mosses of S. Arizona 169). Known also from Mexico south to the Andes in Bolivia; also in southern Europe and tropical Asia and Africa.

Bartram's plants undoubtedly belong to this species, though perhaps worthy of varietal rank only; the leaves are shorter, more recurved when moist and more sharply toothed at apex than the other plants I have examined. The leaves vary in much the same way and to the same extent as in *C. purpureus.* The leaves of the type of *C. vulcanicus* approach those of Bartram's plants but are less strongly toothed above.

Mrs. Britton's synonymy has been adopted without change or verification (N. Am. Flora **15**[1]: 61).

4. CERATODON HETEROPHYLLUS Kindb. Ottawa Nat. **5**: 179. 1892.

Plants in thin dense sods, about 1 cm. high, light yellow-green above, dark reddish-brown below; stems branching freely by slender innovations, julaceous by the appressed leaves when dry, only the upper leaves slightly contorted; *leaves of the sterile shoots concave, spoon-shaped, obtuse and entire or nearly so,* those of the larger shoots reaching 0.5 mm. long; upper cells subquadrate, thick-walled, 10–25 μ in diameter, elongated and thinner-walled at base; costa stout, usually ending below the apex, colored in the older leaves; basal leaves of fertile plants much like the above, the median oblong-lanceolate and obtuse, with the entire margins more or less revolute, occasionally a lanceolate acute leaf; perichaetial leaves sheathing, the outer abruptly subulate, the inner obtuse; basal cells of upper and perichaetial leaves more elongated and less incrassate to midway of the leaf or more. Seta orange, 1 cm. or more in length; capsules red to orange, *mostly slightly inclined,* occasionally horizontal, *plainly strumose,* about 1 mm. long; otherwise as in *C. purpureus.*

Type locality, on soil, St. Paul Island, Behring Sea (J. M. Macoun, Aug. 8, 1891). Described from a specimen of this collection. Also reported from Agattu Id. *Pl. 16D.*

This is so distinct that it is difficult to see the reason for reducing it to a mere form of *C. purpureus.*

6. SAELANIA Lindb. Utkast 35. 1878.

Differs from *Ditrichum* in the more frequent subapical innovations; leaves glaucous with a white filamentous or granular dorsal surface, lamina plainly extending nearly or quite to the apex, mainly plane, distantly and coarsely serrate.

Many authors have included this in *Ditrichum,* but recent works treat it as more closely allied to *Ceratodon.*

SAELANIA GLAUCESCENS (Hedw.) Broth. Engler & Prantl (Ed. 1) Musci 300. 1901.

Trichostomum glaucescens Hedw. Stirp. Crypt. **3**: 91. 1792; Sp. Musc. 112. 1801.
Leptotrichum glaucescens Hampe, Schimp. Syn. 146. 1860.
Ditrichum glaucescens Hampe, Flora **50**: 182. 1867.
Saelania caesia Lindb. Utkast 35. 1878.

Plants *densely cespitose, glaucous-green;* stems erect, slender, 1–2 cm. high, freely branching; lower leaves small, lanceolate below, acute to acuminate, larger above, upper and perichaetial 1.5–2 mm. long, more crowded, gradually linear-subulate, from a broader base, not sheathing, erect-open, somewhat contorted when dry; margins plane or slightly recurved below, bluntly serrate above; costa stout, sometimes slightly rough on the back at apex, percurrent, to slightly excurrent in the upper leaves; upper blade cells short-rectangular, rather thick-walled and slightly rounded at the corners, 1–2 : 1, more elongated at base, sometimes bi-stratose along the margins. Autoicous; antheridia terminal on short branches below the perichaetia; seta 5–10 mm. long; calyptra cucullate; capsule erect and symmetric, slightly wrinkled when dry; urn 1.5–2.25 mm. long, oblong-cylindric, broadest near base; operculum conic-rostrate, reaching 0.7 mm. in length; annulus large, of 2–3 rows of cells; peristome deep red, from a short basal membrane, teeth bifid into capil-

lary divisions, spinose-papillose and more or less united at the nodes; spores faintly papillose, about 15 μ in diameter, mature in summer.

Type locality, Sweden.

ILLUSTRATIONS:—Bry. Eur. *pl. 184;* Braithw. Brit. Moss Fl. **1:** *pl. 26F; Pl. 18F.*

EXSICCATI:—Drumm. Musc. Am. 177; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 156; Aust. Musc. Appal. 121; Macoun, Can. Musci 68; Holz. Musc. Acro. Bor. Am. 13.

On thin soil in rock crevices in alpine and subarctic regions; Greenland to Alaska, south to New England, New Jersey, Minnesota and the Rocky Mts.; not common.

Distinguished by the glaucous-green color which Braithwaite says is due to a mealy production on the leaves.

7. DITRICHUM [Timm] Hampe, Flora, **50:** 181. 1867 (nomen conservandum).

Leptotrichum Hampe, Linnaea **20:** 74. 1847.

Plants small, loosely or closely gregarious; stems with few exceptions less than 1 cm. high, leaves not distichous, lanceolate-subulate, often with a linear-filiform awn, entire or serrate, basal cells rectangular to oblong, without inflated angular cells (except forms of *flexicaule*), upper cells linear, rectangular, or oval; costa broad and strong, usually percurrent or excurrent; perichaetial leaves usually larger and more or less sheathing at base. Dioicous or monoicous; seta slender, long exserted; calyptra cucullate; capsules ovoid to cylindric, mostly erect and symmetric but sometimes arcuate or inclined, smooth to somewhat wrinkled when dry; operculum conic to short-rostrate; annulus present, usually large; peristome usually from a short basal membrane, the 16 teeth usually more or less completely split into two filiform divisions, in most cases plainly papillose, sometimes slightly twisted.

Type species, *D. pusillum.* Both the peristome and the leaf structure show a close affinity to *Trichostomum* and related genera of the Pottiaceae.

KEY.

1.	Plants (except occasional sterile forms) not over 1.5 cm. high, usually less	2.
	Plants normally 5–10 cm. or more in height	11.
2.	Awn more or less rough throughout	3.
	Awn smooth or rough only at extreme apex	4.
3.	Seta 10–15 mm. long; capsule narrowly cylindric	*11. cylindricum.*
	Seta 5–7 mm. long; capsule ovoid-cylindric	*12. boreale.*
4.	Seta bright yellow; capsules wrinkled when dry; spores rough	5.
	Seta red to brown (pale yellow in *montanum*), capsules not often wrinkled; spores smooth	6.
5.	Awn serrulate; spores 14–18 μ in diameter; eastern	*9. pallidum.*
	Awn nearly entire; spores 21–27 μ; western	*10. Schimperi.*
6.	Leaf margins more or less recurved and serrulate above; dioicous	7.
	Leaf margins plane or incurved	10.
7.	Operculum long conic-rostrate, ⅓–½ the length of the urn; peristome teeth 0.5–1 mm. long, spinose-papillose, almost without nodes except at very base	8.
	Operculum short-conic; peristome teeth 0.2–0.35 mm. long; peristome teeth faintly papillose, nodose at base	9.
8.	Perichaetial leaves entire to slightly serrate	*3. ambiguum.*
	Perichaetial leaves strongly serrate	*4. tortuloides.*
9.	Perichaetial leaves with awn equal in length to broad base or much longer	*1. pusillum.*
	Awn of perichaetial leaves much shorter than the sheathing base	*2. lineare.*
10.	Leaf margins unistratose, cells of upper blade much longer than broad	*6. heteromallum.*
	Leaf margins bistratose, upper cells little longer than broad	*5. montanum.*
11.	Leaves 1–3 mm. long; perichaetial leaves gradually subulate	*7. flexicaule.*
	Leaves 5–7 mm. long; perichaetial very abruptly subulate	*8. giganteum.*

1. DITRICHUM PUSILLUM (Hedw.); E. G. Britton, N. Am. Fl. **15**[1]: 62. 1913.

Didymodon pusillus Hedw. Sp. Musc. 104. 1801.

Trichostomum tenue Hedw. l. c. 107.

Leptotrichum pusillum Hampe, Linnaea **20:** 74. 1847.
Leptotrichum tortile C. Müll. Syn. **1:** 454. 1848.
Ditrichum tortile Brockm. Laubm. Meckl. 74. 1869.
Leptobarbula berica Macoun, Cat. Can. Pl. **6:** 49, 1892. Not of Schimper 1876.

Plants in thin dense sods, light to yellowish-green, often very dark with age, variable in the size of all parts; stems mostly simple, erect from a radiculose base, sometimes inclined toward the light, 5–10 mm. or more long; lower leaves lanceolate, about 1 mm. long, the upper 2–3 mm. long, lanceolate-subulate, erect to somewhat spreading, *little contorted when dry*, canaliculate above; *margins somewhat revolute*, more or less serrulate, especially above; costa broad, percurrent to excurrent into a subulate apex, which is channelled and denticulate; lower leaf cells narrowly rectangular to hexagonal, pellucid, sometimes colored at base, thin-walled, smooth, 10–15 μ wide, 2–5 : 1 in the perichaetial leaves; shorter and smaller in the lower leaves; upper blade cells smaller and thicker-walled, about 2 : 1, the apical sometimes bistratose; perichaetial leaves with a longer oblong base, more or less sheathing. Dioicous; antheridia terminal; seta red-brown, 5–15 mm. long; calyptra cucullate; capsule oblong-cylindric to ovoid, 0.5–1.5 mm. long, reddish to brown, not sulcate or constricted below the mouth when dry; exothecial cells irregularly short-rectangular to polygonal; annulus of large cells; peristome short, of 16 reddish teeth split into linear-subulate divisions nearly to the base, united into a short basal membrane, papillose, trabeculate below, often slightly twisted; operculum conic-rostellate; spores smooth, 10–15 μ in diameter, mature in autumn.

Type locality, Leipzig, Germany.

ILLUSTRATIONS:—Hedw. l. c. *pl. 24;* Jennings, Mosses W. Pennsylvania *pl. 6; Pl. 28.*
EXSICCATI:—Drumm. Musc. Am. 118, S. States 57–59; Sull. Musc. Allegh. 175; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 103, (Ed. 2) 152, 153; Aust. Musc. Appal. 118; Macoun, Can. Musci 65, 486, Grout, Musci Perf. 109.

On moist bare soil, banks, ditches and fields; Labrador to Katmai Id., Alaska; south to British Columbia, California (doubtfully), Louisiana and Florida; common in the northern U. S. on soil denuded and not yet occupied with other vegetation. Often found with *Pogonatum pennsylvanicum.*

Exceedingly variable in all parts, often due to environmental conditions, and grading into the next.

2. DITRICHUM LINEARE (Sw.) Lindb. Acta Soc. Sci. Fenn. **10:** 108. 1871.

Didymodon lineare Sw. Adnot. Bot. 100. 1829.
Trichostomum vaginans Sull. Musc. Allegh. 176. 1845.
Leptotrichum vaginans Schimp. Syn. (Ed. 2) 140. 1876.
Trichostomum nodulosum Aust. Bull. Torr. Club **6:** 73. 1876.

Differs from the preceding in the following particulars; *stems branching freely by slender innovations;* leaves blunt, margins less serrulate and less revolute, awn shorter; perichaetial leaves long-sheathing, short-awned; capsule longer, urn reaching 1.75 mm. long, usually about 1.5 mm., nearly cylindric and often slightly wrinkled when dry; operculum 0.5 mm. high; annulus larger, often of one row of very large cells with two rows of smaller cells at base; peristome more irregularly divided.

Type locality, Lancaster, Pa.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 28; Pl. 28.*
EXSICCATI:—Drumm. Musc. Am. 60, 61; Sull. Musc. Allegh. 176; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 104, (Ed. 2) 154; Aust. Musc. Appal. 119; Macoun, Can. Musci 386; Holz. Musc. Acro. Bor. Am. 311 (as *D. heteromallum*).

Habitat similar to the last; Prince Edward Id. to S. Carolina and Missouri; also in Europe.

Although most recent authors consider it distinct from the last, there are many intermediate forms, and plants from the same tuft vary in the distinguishing characters. Mrs. Britton to the contrary notwithstanding, the perichaetial leaves of *D. pusillum* are always more or less sheathing. Immature peristomes of both species are less papillose than those fully mature.

Austin's Musci Appal. Suppl. 490 from the White Mts. of New Hampshire as *D. homomallum* is certainly not that species as the leaf margins are revolute and bistratose. It seems close to *D. vaginans subvaginans* Roth. The leaves are longer and more serrulate than in *lineare* and the awn from once to twice the length of the sheathing base. It is approached by Holzinger's Musc. Acro. Bor. Am. 311. The peristomes of both these forms seem like those of typical *D. lineare.*

3. DITRICHUM AMBIGUUM Best, Bull. Torr. Club **20:** 117. 1893.

Plants gregarious, about 1 cm. high, light to dark green; leaves erect-spreading from imbricate bases, somewhat crisped when dry, the lower lanceolate, 1 mm. or less in length, the upper long-lanceolate-subulate,

2 mm. or more in length, clasping at base, canaliculate above, upper margins entire or serrulate, more or less recurved, undulate and bistratose; perichaetial leaves larger and long-sheathing, not abruptly narrowed, *nearly entire except at the extreme apex;* leaves of sterile stems more strongly serrate, often narrowly obtuse; costa percurrent, more or less papillose on the back near apex; basal leaf cells of lower leaves short-rectangular, about 2 : 1, thick-walled; cells of the sheathing base of perichaetial leaves oblong-hexagonal, thin-walled, 10–15 μ wide, 5–7 : 1. Dioicous; seta about 1 cm. long, red; capsule oblong- to narrowly cylindric, often slightly unsymmetric, *1–2 mm. long*, 0.4–0.5 mm. thick; *operculum long, conic-rostrate, 0.6–0.8 mm. long;* annulus large, of 2–3 rows of cells; exothecial cells oblong-rectangular, moderately incrassate, 15–18 μ wide, 3–5 : 1; peristome teeth red, 0.4–0.55 mm. long, divided to the narrow basal membrane into *two capillary segments, not nodose or trabeculate, rarely connate, strongly spinose-papillose as in D. pallidum, papillae more than 1 μ high;* spores smooth, 9–11 μ, mature in late autumn to winter.

Type locality, Mason Co., Washington. *Pl. 29.*

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 137, 613 (as *D. pusillum*).
On banks of bare soil; California, Washington, Oregon, and British Columbia.
Occasionally the peristome teeth will show signs of nodes near the base.

4. DITRICHUM TORTULOIDES Grout, Bryol. **30**: 4. 1927.

Too near the last, differing chiefly in the smaller size, strongly serrate and undulate perichaetial leaves and rather shorter, thicker-walled and more colored basal cells of the same; spores in spring.

Type locality, Newfane, Vt. *Pl. 29.*

EXSICCATI:—Grout, Musci Perf. 89 (from the type locality).
On soil in old roads and on banks; also from Jackson, N. H., Staten Island, N. Y., and in central Europe.

5. DITRICHUM MONTANUM Leiberg, Bull. Torr. Club **20**: 112. 1893.

Plants loosely cespitose; stems 5–10 mm. long, rarely twice that, sparingly branched; leaves erect-open when moist, somewhat contorted but scarcely crisped when dry, lanceolate-subulate, not papillose, the upper and perichaetial reaching 2 mm. or more in length, *canaliculate with incurved subserrulate margins*, which are narrowly bistratose; costa broad, ending in or below the serrulate apex; lamina narrow above, consisting of irregular to subquadrate incrassate cells about 10 μ wide; in the median lamina the cells are short-rectangular becoming gradually longer to the colored basal cells; in the perichaetial leaves the cells of the sheathing base are much longer, reaching 30 x 140 μ, and thin-walled. Autoicous; antheridia terminal on basal branches; *seta yellow*, 1.5–2.5 cm. long; capsule 2–3 mm. long, erect and symmetric, ovoid-cylindric, narrowest at the mouth, sometimes shriveled but not plicate when dry; calyptra ⅓ length of capsule; operculum conic-rostrate; annulus double; peristome teeth bifid nearly to the short basal membrane, nodose at base, the divisions filiform and spinose-papillose; *exothecial cells narrowly linear-oblong and pale* except for a few rows of short irregular reddish cells around the mouth; spores smooth, about 10 μ in diameter, apparently mature in spring.

Type locality, Idaho.

ILLUSTRATIONS:—Bull. Torr. Club l. c. *pl. 143; Pl. 31.*
On bare soil and roots of trees; Idaho and Washington; apparently rare and of limited distribution.
Closely allied to *D. ambiguum* but distinct in the incurved margins of the leaves, the shorter leaf cells, the yellow seta and the elongated exothecial cells.

6. DITRICHUM HETEROMALLUM (Hedw.) E. G. Britton, N. Am. Flora **15**[1]: 64. 1913.

Weisia heteromalla Hedw. Stirp. Crypt. **1**: 22. *pl. 8.* 1787; Sp. Musc. 71. 1801.
Didymodon homomallum Hedw. Sp. Musc. 105. 1801.
Trichostomum homomallum Bry. Eur. *pl. 181.* 1843.
Ditrichum homomallum Hampe, Flora **50**: 182. 1867.

Plants loosely tufted, pale to yellowish-green; stems mostly simple, 5–10 mm. high, rarely branching and reaching 4 cm.; leaves spreading, twisted or subsecund above when dry, *gradually narrowed* to a *long filiform concave awn* from an ovate or broadly lanceolate base *much shorter than the awn*, 2, rarely 3, mm. long; *margins plane, entire except occasionally toothed at apex* and rarely below in some leaves; costa broad, excurrent into the slender awn; lower leaf cells narrowly rectangular to linear near the margin, shorter above,

all slightly incrassate; perichaetial leaves sheathing at base, longer and rather more abruptly narrowed. Dioicous; seta red, 1–2 cm. long; capsule dark red, oblong to oblong-ovoid, erect and symmetric or nearly so, urn 2 mm. or more long; operculum long-conic; annulus large, of 2–3 rows of cells; peristome red, from a narrow basal membrane, teeth divided into filiform, lightly papillose segments, more or less united at the joints below, reaching 0.3 mm. in length; spores smooth, 12–14 μ in diameter; maturing autumn to winter.

Type locality, Saxony, Germany.

ILLUSTRATIONS:—Hedw. l. c. *pl. 23;* Bry. Eur. *pl. 181; Pl. 30.*
EXSICCATI:—Drumm. Musc. Am. 119; Macoun, Can. Musci 451; Holz. Musc. Acro. Bor. Am. 511.
Mountain regions from the west side of the Rockies to California, Washington and Alaska; Nova Scotia (Prince); also in Europe; rare.

7. DITRICHUM FLEXICAULE (Schwaegr.) Hampe, Flora **50:** 182. 1867.

Cynodontium flexicaule Schwaegr. Suppl. 1[1]: 113. *pl. 29.* 1811.
Trichostomum flexicaule Bry. Eur. fasc. 18–20. *pl. 180.* 1843.
Leptotrichum flexicaule Hampe, Linnaea **20:** 74. 1847.

Plants typically *in dense tomentose sods 2–10 cm. thick, silky* and yellowish-green above, *brown and matted with tomentum below,* sometimes shorter or less dense; stems erect and crowded or loosely tufted and flexuose, fragile and branched; leaves not crowded but overlapping, erect to spreading, somewhat contorted when dry, often somewhat secund, 1–4 mm. long, from a long-lanceolate base gradually narrowed to a much longer filiform concave awn, entire or slightly toothed at apex; costa broad, excurrent; basal leaf cells oblong-rectangular, about 15 μ wide, 2–3 : 1, the alar inflated-quadrate; median cells of leaf base oblong-linear, incrassate, sometimes with walls more or less pitted; marginal basal cells shorter except that the marginal row is sometimes linear; cells along the costa above the broad base rounded, short, linear to nearly quadrate, smaller; perichaetial leaves from a much larger oblong-sheathing base more abruptly narrowed to the long awn. Dioicous; male plants slender; bracts ovate, subulate, the inner ecostate; seta reddish, 1–2.5 cm. long; capsule erect, reddish-brown, oblong-cylindric to ovoid, enlarged at base, narrowest at mouth; urn 1–2 mm. long; exothecial cells irregularly oblong-hexagonal; operculum conic-cylindric, appearing rostellate when dry, up to 0.6 mm. long; peristome red, 0.4–0.5 mm. long, teeth bifid nearly to the short basal membrane, sometimes with the divisions irregularly united at base, filiform and spinose-papillose, not trabeculate or nodos eexcept near the base, more or less unequal; annulus large; spores 7–10 μ, smooth, maturing in spring.

Type locality, Switzerland.

ILLUSTRATIONS:—Bry. Eur. l. c.; Braithw. Brit. Moss Fl. *pl. 15A;* Dixon, Handb. Brit. Mosses (Ed 3) *pl. 8H; Pl. 29, 30.*
EXSICCATI:—Macoun, Can. Musci 461, 490; Holz. Musc. Acro. Bor. Am. 562.
On moist shaded banks and ledges, preferably limestone, in alpine and subarctic regions; Greenland and Nova Scotia to Ontario, Minnesota, British Columbia and Alaska.
This species is exceedingly variable especially in the sterile forms which principally represent it in N. America. The following are frequent.

7a. Var. DENSUM (Bry. Eur. l. c.) Braithw. Brit. Moss Fl. **1:** 101. 1881.

Leptotrichum flexicaule var. *densum* Bry. Eur. l. c.
Distichium Macounii C. M. & Kindb.; Macoun, Cat. Can. Pl. **6:** 40. 1892.

Densely tufted, shorter, 2–5 cm. high; leaves nearly erect, much shorter, straight, almost entire; elongated cells in base almost or quite lacking; leaf cells incrassate, rounded, isodiametric to somewhat longer than broad, lumen 7–12 μ wide. This merges into its form *brevifolium. Pl. 29.*

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 535 (as var. *brevifolium*); Drumm. Musc. Am. 126.

7b. f. BREVIFOLIUM (Kindb.) **n. comb.**

Leptotrichum flexicaule subsp. *brevifolium* Kindb.; Macoun, Cat. Can. Pl. **6:** 46. 1892.
Ditrichum elatum Kindb. Eur. & N. Am. Bryin. 181. 1897.

Leaves very short and straight, sometimes only 1 mm. long, broadly lanceolate to lance-subulate from an ovate base. *Pl. 29.*

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 359 & 12. This last is not the extreme form. Ontario, Minnesota and elsewhere with the species.

These forms are found frequently east of the Rockies in the Mississippi valley and in southern Canada, especially in arctic-alpine regions. They are so different that one not familiar with the variations of this species would never suspect their relationship. Intermediate graduated forms make this certain however. Probably these varieties are reduced forms due to unfavorable conditions.

8. DITRICHUM GIGANTEUM Williams, Bull. N. Y. Bot. Gard. **2**: 113. 1901.

Didymodon flexicaule sterile DeNot. Syll. Musc. 197. 1838.
Ditrichum flexicaule longifolium I. Hagen, Tromso Mus. Aarsh. **21–22**: 40. 1899.

Plants in lax yellow-green cushions up to 12 cm. high; differing from the last in the longer (5–7 mm.) leaves, subtubulose at base, more noticeably serrate at apex; *perichaetial leaves very abruptly rounded to a filiform awn from a broadly ovate sheathing base;* peristome without a basal membrane, teeth mostly entire and not bifid; spores in autumn.

Type locality, Columbia Falls, Montana (Williams).

ILLUSTRATIONS:—Bull. N. Y. Bot. Gard. l. c. *pl. 15; Pl. 31.*
EXSICCATI:—Holz. Musc. Acro. Bor. Am. 404; Drumm. Musc. Am. 125.

On gravel banks and sand bars and in crevices of rocks; Rocky Mts. from Montana to the Yukon; around the Great Lakes in Minnesota and Michigan. Also in Europe.

9. DITRICHUM PALLIDUM (Schreb., Hedw.) Hampe, Flora **50**: 182. 1867.

Trichostomum pallidum Hedw. Sp. Musc. 108. 1801.
Leptotrichum pallidum Hampe, Linnaea **20**: 74. 1847.
Ditrichum rhynchostegium Kindb. Rev. Bryol. **37**: 14. 1910.

Plants loosely gregarious, bright yellow-green; stems about 5 mm. long, more or less erect from a creeping base, mostly simple, central strand large; leaves erect-spreading, sometimes secund, somewhat contorted when dry, long linear-subulate from a lanceolate base (often ovate in the upper and perichaetial), concave, channelled above; margins often distantly serrate in upper basal part and of more than one layer of cells along the costa; costa strong, long-excurrent, toothed towards the apex; basal cells laxly oblong-hexagonal, up to 65 x 25 μ or more, narrower toward the margin, thin-walled; along the shoulders of abruptly narrowed perichaetial leaves are a variable number of much smaller irregular cells; perichaetial leaves subclasping. Paroicous; antheridia in axillary buds below the perichaetium; seta 1–4 cm. long, slender, *yellow to orange;* capsules *mostly inclined and somewhat unsymmetric, faintly strumose, oblong-ovoid, light brown to yellowish;* urn 1–2.5 mm. long, *irregularly sulcate when dry and empty, narrower at the mouth;* operculum conic-obtuse, reaching 1 mm. in length; annulus of 1–3 rows of cells; calyptra cucullate, smooth, rostrate, reaching 2.5 mm.; peristome teeth 16, 0.5 mm. or more long, from a short basal membrane, divided more or less completely into two filiform segments, closely *spinose-papillose,* reddish; spores coarsely warty, 14–18 μ in diameter, mature in early spring in the North, in Feb. to April in Florida.

Type locality, near Leipzig, Germany.

ILLUSTRATIONS:—Bry. Eur. *pl. 183;* M. H. M. *f. 33;* Jennings, Mosses W. Pa., *pl. 6; Pl. 28.*
EXSICCATI:—Drumm. Musc. Am. S. States 56; Sull. Musc. Allegh. 174; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 105, (Ed. 2) 155; Aust. Musc. Appal. 120; R. & C. Musc. Am. Sept. 22; Macoun, Can. Musci 67; Holz. Musc. Acro. Bor. Am. 14; Grout, Musci Perf. 47.

Dry sandy fields; Nova Scotia to Ontario, south to Florida, Texas and Oklahoma.

The majority of American plants have a less abruptly narrowed base in the perichaetial leaves than the European. Specimens from Nova Scotia (Miss Margaret Brown) have a longer oblong, clasping base with a larger number of small irregular cells at the leaf shoulders than is normal in European plants, and a peristome rather more than 1 mm. long.

10. DITRICHUM SCHIMPERI (Lesq.) Paris, Index Bryol. 391. 1895.

Leptotrichum Schimperi Lesq. Mem. Calif. Acad. **1**: 9. 1868.

Plants gregarious, yellowish; stems erect, mostly simple, 3–5 mm. long; leaves close, erect-spreading, somewhat secund and flexuose when dry, long filiform-subulate from a short ovate to lanceolate base, 3–5 mm. long, entire except at apex; costa broad, nearly filling the awn, percurrent to excurrent; basal leaf cells

oblong, thin-walled, about 15 μ wide, 4–7 : 1, marginal narrower; cells of upper base shorter, many short-rectangular, those along the costa linear; perichaetial leaves sheathing at base. *Autoicous; antheridia in small buds below the perichaetium;* seta yellowish, 1–2 cm. long; capsules erect to inclined, 1.5–2.5 mm. long, ovoid-cylindric, somewhat furrowed when dry; operculum short-rostrate; *calyptra large, cucullate and twisted; annulus narrow;* peristome *about 0.3 mm. long,* from a narrow basal membrane; teeth red, divided into 2 filiform segments above, irregularly perforate or divided below, *papillose, nodose only at base; spores large, 21–27 μ, rough,* mature in June.

Type locality, Coast Ranges near Mendocino City, California.

ILLUSTRATIONS:—Sull. Icones Musc. Suppl. *pl. 24; Pl. 32.*
EXSICCATI:—Holz. Musc. Acro. Bor. Am. 310.
On clay soil and banks; California to Vancouver Id.
The peristome is shorter and less strongly papillose than in *D. pallidum* and the seta less conspicuously yellow.

11. DITRICHUM CYLINDRICUM (Hedw.) n. comb.

Trichostomum cylindricum Hedw. Sp. Musc. 107. *pl. 24. f. 7-13.* 1801. Not of C. Muell. 1849.
Trichodon tenuifolius Schrad. Lindb. Oefv. Sv. Vet.-Akad. Förh. **21**: 225. 1864.
Ceratodon cylindricus Bry. Eur. fasc. 29–30. *pl. 192.* 1846.
Didymodon cylindricus Wahlenb. Fl. Suec. **2**: 754. 1826. Not of Bry. Eur.

Plants in loose thin yellowish-green tufts; stems short, rarely over 5 mm. long, slender, mostly simple; radicles sometimes producing small brown tubercles; leaves 1–2 mm. long, the base oblong to ovate, sheathing, abruptly contracted to a linear-subulate awn much longer than the base, recurved, *flexuose and very rough;* costa strong, filling the whole upper part of the awn; basal cells smooth, oblong, 7–15 μ wide, 4–7 : 1, sometimes colored; upper cells of blade shorter and irregular; upper leaf margin plane and more or less irregular in outline; perichaetial leaves longer, and longer-sheathing. Dioicous; male plants in separate tufts; seta slender, 10–15 mm. long, yellow to red; calyptra cucullate; *capsule narrowly cylindric, not plicate when dry,* usually somewhat curved, erect or inclined; urn reaching 2 mm. long; median exothecial cells about 1 μ wide, 5–8 : 1, incrassate; operculum bluntly conic, 0.4 mm. high; annulus large, revoluble; peristome red to yellowish, teeth *very minutely papillose,* slender, split nearly to the base into capillary divisions which are more or less united at the nodes below; spores smooth, 12–14 μ in diameter, mature in summer.

Type locality, Germany.

ILLUSTRATIONS:—Bry. Eur. l. c.; Hedw. l. c.; *Pl. 33.*
EXSICCATI:—Macoun, Can. Musci 411; R. & C. Musc. Am. Sept. 278; Grout, Musci Perf. 114; Holz. Musc. Acro. Bor. Am. 549.
Wet sandy soil in fields, ditches and banks; western North America, Yukon to Montana, Nevada and Washington. Apparently infrequent.
I agree with Braithwaite and Dixon that this is better placed in *Ditrichum* than in a separate genus. The fact that *Trichostomum cylindricum* (Bruch) C. Müll., an entirely different species belonging in the *Pottiaceae,* has also been called *Didymodon cylindricus* has caused considerable confusion.

12. DITRICHUM BOREALE (Williams) n. comb.

Trichodon borealis Williams, Bryol. **14**: 5. 1911.

Plants loosely gregarious, growing with other species; stems simple or branching from subapical innovations, 2–5 mm. high; leaves distant below, larger above, reaching 2 mm. or more in length, from an ovate clasping base rather gradually narrowed to a spreading-flexuous, subulate, channelled apex, which is more or less papillose-roughened on the back and serrulate along the margins; costa strong, but not filling all of the awn except in some cases at and near the apex; leaf cells smooth, irregularly rectangular, about 6 x 8–12 μ, the lower and basal much longer, oblong-hexagonal to oblong-rectangular; inner perichaetial leaves with a broader sheathing base more abruptly narrowed to a rough spreading awn. Dioicous; seta brownish, straight or flexuose, 5–7 mm. long; capsule erect or inclined, slightly unsymmetric; urn up to 1 mm. long; operculum conic, blunt or apiculate; annulus large, of 3 rows of cells; peristome teeth not quite smooth, divided into two narrow prongs nearly to the base, 8–9 jointed; spores smooth, about 12 μ in diameter, mature in summer.

Type locality, near Dawson, Yukon Terr., July 9, 1899.

ILLUSTRATIONS:—Bryol. l. c. *pl. 2; Pl. 33.*

Type seen; collected among various other species on damp earth in a small ravine just back of Dawson. Differs from the preceding by the seta and capsule only about ½ as long, the shorter operculum, the shorter less papillose peristome and the less roughened awn of the perichaetial leaves.

Family SELIGERIACEAE.

Plants very small (except *Blindia*), gregarious, growing exclusively on a rocky substratum of sandstone or limestone; stems simple or branching; leaves mostly subulate from a broader base, entire or serrulate, awn in most cases consisting chiefly of the percurrent or excurrent costa; leaf cells smooth, the basal more elongated, the alar differentiated in *Blindia* only; perichaetial leaves usually larger and with a longer awn; seta well exserted, straight or curved; *capsules small, short-ovoid to pyriform, often with a broad mouth and turbinate when dry;* operculum rostrate; peristome usually present, single, *of 16 undivided teeth without a median line, entire, partially split or perforate.*

KEY TO THE GENERA.

1.	Plants very small, less than 1 cm. high; alar cells not enlarged	2.
	Plants much larger; alar cells enlarged	3. *Blindia.*
2.	Capsule not striate; peristome teeth, if present, smooth; annulus lacking	1. *Seligeria.*
	Capsule striate; teeth truncate, papillose; annulus present	2. *Brachydontium.*

1. SELIGERIA Bry. Eur. fasc. 33–36. 1846.

Plants very small, mostly 5 mm. high or less; stems simple or with short basal branches, occasionally with longer innovations, central strand present; the upper leaves longer, crowded, mostly subulate from a broader often clasping base; costa of uniform cells, often thick and excurrent; lower leaf cells larger and thinner-walled than the upper; perichaetial leaves not much different, often larger with a longer awn; seta well exserted, erect or curved; calyptra cucullate; capsule ovoid to pyriform, very small, mostly with a short neck; operculum rostrate; annulus lacking; peristome sometimes lacking, when present of 16 teeth, mostly entire and smooth, sometimes thick at the nodes, erect or recurved when dry.

Type species, *S. pusilla.*

KEY.

1.	Peristome lacking; leaves more or less serrulate	1. *Doniana.*
	Peristome present; leaves serrulate or entire	2.
2.	Seta straight or nearly so; capsules broadest at the mouth	3.
	Seta recurved when moist; capsules slightly narrowed at the mouth, or at least no wider than in the middle	6.
3.	Capsule urn hemispheric, without neck; columella persistent	4. *tristichoides.*
	Capsule urn pyriform or turbinate, with a distinct neck; columella not persistent	4.
4.	Stem 1 mm. high or less; leaves not 3-ranked	5.
	Stem 3–10 mm. high, or more	7.
5.	Leaves finely serrulate, the awn long, slender, and tapering	3. *pusilla.*
	Leaves entire or nearly so, the awn short, thick, and abrupt	2. *calcarea.*
6.	Leaves entire; costa filling the long smooth awn	6. *recurvata.*
	Leaves often serrulate; costa not filling the short papillose apex	7. *campylopoda.*
7.	Plants smaller (up to 5 mm.); leaves trifarious, perichaetial reaching 1.5 mm.	5. *trifaria.*
	Plants larger (5 mm. or over); leaves not trifarious, perichaetial reaching 2 mm.	8. *polaris.*

1. SELIGERIA DONIANA (Sm.) C. Muell. Syn. 1: 420. 1848.

Gymnostomum Donianum Sm. Engl. Bot. *pl. 1582.* 1806.
Anodus Donianus Bry. Eur. fasc. 33–36. *pl. 109.* 1848.
Seligeria Donii Lindb. Oefv. Sv. Vet.-Akad. Förh. **21**: 187. 1864.

Plants minute, gregarious; stems erect, rarely 1 mm. long, simple or branching from the base; leaves crowded, erect, straight, reaching 1 mm. long, subulate from a broader ovate-lanceolate, serrulate base;

costa strong, percurrent or short-excurrent in the upper leaves, occupying the greater part of the minutely denticulate awn; basal cells oblong, rectangular or rhomboidal, clear, rather incrassate, the upper shorter; perichaetial leaves lanceolate, gradually narrowed, more or less sheathing. Autoicous; antheridia in basal buds; seta straight, reaching 2 mm. long; capsule minute, pyriform, hemispherical to turbinate when dry and empty, with a short stomatose neck, without the obliquely conic-rostrate operculum about 0.5 mm. long; peristome lacking; spores smooth, 8–10 μ in diameter, mature in late summer.

Type locality, England.

ILLUSTRATIONS:—Bry. Eur. l. c.; Braithw. Brit. Moss Fl. **1**: *pl. 16G; Pl. 35*.
EXSICCATI:—Drumm. Musc. Am. 22; Sull. Musc. Allegh. 142 (in part); Grout, Musci Perf. 178.
Moist hollows and crevices of ledges, rare. Ontario, Maine, New York, New Jersey, Ohio, Tennessee; Minnesota to Alberta; most frequently collected in Ontario.

2. SELIGERIA CALCAREA (Dicks., Hedw.) Bry. Eur. l. c. *pl. 110*. 1846.

Weissia calcarea Hedw. Sp. Musc. 66. *pl. 11*. 1801.

Surprisingly like *S. Doniana;* differs in the leaves entire or nearly so, with awn stouter; peristome present, incurved or recurved when dry, red brown, teeth fragile, smooth.

Type locality, England.

ILLUSTRATIONS:—Hedw. l. c.; Bry. Eur. l. c.; Braithw. Brit. Moss. Fl. **1**: *pl. 17B; Pl. 34*.
EXSICCATI:—Drumm. Musc. Am. 65; Sull. Musc. Allegh. 142 (in part).
On wet limestone rocks; near Columbus, Ohio; near Chilson Lake, New York; Ontario to Manitoba.

3. SELIGERIA PUSILLA (Hedw.) Bry. Eur. l. c. 1846.

Weisia pusilla Hedw. Stirp. Crypt. **1**: 74. *pl. 28*. 1787.
Didymodon pusillus Hedw. Sp. Musc. 104. 1801.

Plants minute, in loose dark-green tufts; stems simple or branching from the base, about 1 mm. high; lower leaves short, lanceolate-subulate; upper longer, *long filiform-subulate* from *a denticulate base*, reaching 2 mm. long; margins incurved, *subdenticulate;* basal cells much as in the two preceding. Autoicous; antheridia in lateral buds; seta erect, much longer than perichaetial leaves, 1.5–3 mm.; *capsule obovoid-pyriform*, erect and symmetric, with beaked operculum about 1 mm. long; neck conspicuous, stomatose; exothecial cells incrassate, short and irregular, little longer than broad; *peristome teeth reddish, broadly lanceolate, smooth, entire, with 6–8 distinct joints*, inserted below the mouth, reflexed when dry, incurved when moist; spores 10–14 μ, mature in summer.

Type locality, Hanover, Germany.

ILLUSTRATIONS:—Hedw. l. c.; Bry. Eur. *pl. 110;* Braithw. l. c. *pl. 16H; Pl. 34*.
EXSICCATI:—Drumm. Musc. Am. S. States 35; Holz. Musc. Acro. Bor. Am. 421.
Damp shaded cliffs and ledges, principally limestone; Quebec, Ontario; Kelley's Island, Lake Erie; Minnesota to Missouri.
Quite variable in size and length of leaves.

4. SELIGERIA TRISTICHOIDES Kindb. Rev. Bryol. **23**: 20. 1896.

Seligeria trifaria patula Lindb. Oefv. Sv. Vet.-Akad. Förh. **21**: 189. 1864.
Seligeria tristicha laxa Holz. Bryol. **5**: 9. 1902.
Seligeria tristichoides laxa Holz. l. c. 63. 1902.

Plants in bright green cushions; stems 2–5 mm. high, crowded, sending out numerous slender, short sterile innovations with short, 3-ranked leaves; leaves of fertile stems less conspicuously 3-ranked, spreading to reflexed, the lower shorter, the upper crowded, 1 mm. long (or less), lanceolate-subulate with the percurrent or excurrent costa *forming a stout rough awn;* cells of the hyaline base rectangular to oblong, upper cells much shorter and more dense; perichaetial leaves a little longer. Autoicous; antheridia few, in axillary or basal buds; seta erect or somewhat curved, scarcely twice the length of the perichaetial leaves; *capsules ovoid, the urn hemispheric when empty*, less than 1 mm. high, *without neck; columella more or less persistent* and exserted; stomata imperfect, occurring around the middle of the capsule; exothecial cells incrassate, irregular, little longer than broad, protruding when dry; peristome red, inserted below the capsule mouth, incurved when moist, smooth, occasionally perforate, with 10–12 narrow joints; spores minutely roughened, 18–22 μ in diameter, mature in early summer.

Type locality, Norway.

ILLUSTRATIONS:—Bryol. **5**: 8. *f. 2–5; Pl. 35B.*
Collected but once in N. America by Dr. Geo. G. Kennedy on the cliffs at Lake Willoughby in Northern Vermont.

5. SELIGERIA TRIFARIA (Brid.) Lindb. Oefv. Sv. Vet.-Akad. Förh. **20**: 413. 1863.

Weisia trifaria Brid. Jour. Bot. Schrad. **1801**[1]: 283. 1801.
Weisia tristicha Brid. Musc. Recent. Suppl. **1**: 116. 1806.
Seligeria tristicha Bry. Eur. fasc. 33–36. *pl. 111.* 1846.

Distinguished from *S. tristichoides* by the more slender leaves with a smoother awn; capsules with a conspicuous, stomatose neck; larger spores, 24–32 μ, and the non-persistent columella.
Type locality, Salzburg, Austria.

ILLUSTRATIONS:—Bry. Eur. l. c.; Braithw. Brit. Moss. Fl. **1**: *pl. 16K; Pl. 35.*
Part of Sullivant's Musc. Allegh. 142, which I have seen, is cited by Mrs. Britton as this species and it is reported in the Lesq. & James Manual p. 97 as from Ohio (Sullivant), which is probably the locality of his 142. This would appear to be the only known N. American locality. Through the courtesy of the New York Botanical Garden I have seen the scanty material from "limestone rocks, Gaspé, Quebec" which Mrs. Britton referred to *S. trifaria.* The material is very scanty but the one good capsule has no neck, the one stoma observed is on the lower part of the urn and the leaves are more like those of the Willoughby plant than those of the European *trifaria.* Mrs. Britton's notes accompanying this specimen give its spore measurements as 16–27 μ, too small for *trifaria.*

6. SELIGERIA RECURVATA (Hedw.) Bry. Eur. fasc. 33–36. *pl. 112.* 1846.

Grimmia recurvata Hedw. Stirp. Crypt. **1**: 102. *pl. 38.* 1787; Sp. Musc. 75. 1801.
Seligeria setacea [Wulf.] Lindb. Oefv. Sv. Vet.-Akad. Förh. **20**: 413. 1863.

Plants gregarious in small groups, small; stems 1–3, rarely 5 mm., long, simple or branched; leaves erect-open, the upper larger, 1–1.5 mm. long, gradually long-subulate from a lanceolate base; awn slender, entire, composed principally of the excurrent costa; cells at base hyaline, usually rectangular, shorter, minute and incrassate above; perichaetial leaves longer, broader at the base. Autoicous; antheridia in lateral buds; seta 3–4 mm. long, *flexuose and arcuate when moist;* capsule obovoid to pyriform, with a short stomatose neck, usually slightly narrower at the mouth when dry and empty, urn reaching 0.75 mm. long; operculum long-rostrate; exothecial walls thin, the cells longer than in the preceding species; peristome teeth reddish, smooth, lanceolate, obtuse or acute, with about 10 joints; spores about 10 μ, mature spring to early summer.
Type locality, Klagenfurt, Austria.

ILLUSTRATIONS:—Hedw. l. c.; Bry. Eur. l. c.; Braithw. l. c. *pl. 17C; Pl. 35.*
EXSICCATI:—Aust. Musc. Appal. 110; Allen, Mosses Cascade Mts. 16.
On moist shaded sandstone rocks; New York, New Jersey, Pennsylvania, Washington.

7. SELIGERIA CAMPYLOPODA Kindb.; Macoun, Cat. Can. Pl. **6**: 41. 1892.

Seligeria recurvata arcuata Lesq. & James, Man. 97. 1884.
Seligeria subcampylopoda Kindb.; Engler & Prantl, Musci (Ed. 1) 1176 (nomen nudum) 1909.

Plants small, gregarious; stems mostly 1 mm. or less in height, usually simple, upper leaves crowded, 0.75–1.5 mm. long, narrowly *oblong-lanceolate, acute to obtuse,* open-erect to recurved when moist; costa stout and mostly ending below the apex, somewhat rough on the back; margins entire or subserrulate; upper leaf cells minute, 6–10 μ in width, subquadrate to oblong or elliptical, incrassate, those near the base, rectangular, larger, clearer. Dioicous or monoicous; seta 1–3 mm. long, *typically recurved* but sometimes only slightly flexuose; capsules obovoid or pyriform, *not spreading at the mouth,* with a short neck; urn less than 1 mm. long; operculum long-rostrate; *exothecial cells thin-walled, irregularly oblong;* peristome reddish, deeply inserted; teeth lanceolate with 12–14 joints, sometimes split above or perforate; spores about 10 μ in diameter, mature in autumn.
Type locality, Owen Sound, Ontario.

ILLUSTRATIONS:—Bull. N. Y. Bot. Gard. **2**: *pl. 35; Pl. 35A.*
EXSICCATI:—Drumm. Musc. Am. 66 (as *Weisia Seligeri*); Sull. Musc. Allegh. 141.
On damp shaded rocks; Newfoundland to Montana; Ontario, New York, Ohio, Iowa. Apparently our most common species but rather infrequent.
The small size of these plants causes them to be overlooked and identification is often rendered difficult because the species grow intermingled.

8. SELIGERIA POLARIS Berggr. K. Sv. Vet.-Ak. Handl. **13**: 41. 1875

Blindia polaris Hag. D. K. N. Vid. Selsk. Skrift. **1910**: 99. 1910.

Plants in wide, rather compact cushions, largest of the genus, reaching 2.5 cm. in height but rarely over 5 mm.; stems irregularly much branched; leaves from a broadly ovate subclasping base abruptly or gradually narrowed to a stout awn; costa excurrent, stouter above, smooth; cells of lamina above the broad base quadrate; median basal oblong to sublinear, very incrassate, toward insertion becoming wider and rectangular; angular cells less colored and less incrassate but not inflated or forming auricles; perichaetial leaves larger, reaching 2 mm. in length. Seta somewhat curved when moist, rarely over 2 mm. long; capsule obovoid-globose with very short neck, erect and symmetric; urn 0.6–0.7 mm. high, contracted under the mouth and somewhat turbinate when dry and empty; operculum conic-rostrate; peristome teeth undivided; spores nearly smooth, 12–15 μ in diameter; mature in summer.

Type locality, Spitzbergen (Berggren). *Pl. 36.*

From Arctic N. America I have seen specimens from King Oscar Land and Ellsmere Land. The large size and black color are very distinctive. I have examined with care Berggren's Spitzbergen plants and those from Arctic America. The marked differentiation of alar cells emphasized by Brotherus in Engler and Prantl and in Laubmoose Fennoskandias (p. 43) and other authors, seems to be present in only a small proportion of the leaves and even if present it is difficult of demonstration as they are mostly left on the stem when the leaf is removed.

2. BRACHYDONTIUM Fürnr. Flora **10**[2]: Beil. 37. 1827.

Brachyodon Fürnr. l. c. Beil. 112.
Brachyodus Nees & Hornsch. Bryol. Germ. **2**[2]: 3. 1831.

Minute rock-growing plants with the leaf structure of *Ditrichum* and short truncate peristome teeth; only two known species.

Type species, *B. trichodes.*

1. BRACHYDONTIUM TRICHODES (Weber f.) Bruch, Paris, Index Bryol. (Ed. 2) **1**: 124. 1904.

Gymnostomum trichodes Weber f., Web. & Mohr, Arch. Syst. Nat. **1**: 124. 1804.
Brachyodus trichodes Nees & Hornsch. l. c. 5.

Plants small, gregarious and fruiting freely; stems about 1 mm. long; leaves crowded, imbricate, only slightly contorted when dry, 1–1.5 mm. long, subulate from an ovate or lanceolate clasping base; costa strong, constituting most of the slender awn, which is entire or faintly toothed; basal cells oblong-hexagonal to rectangular, thin-walled and clear, 3–7 : 1, becoming shorter and smaller, thicker-walled and obscure above, not papillose. Autoicous; antheridia in basal buds; seta 2–3 mm. long, yellowish; calyptra mitrate; capsule oblong, erect and symmetric, urn little more than 0.5 mm. long, striate when dry; operculum convex, slenderly rostrate, beak more than 0.5 length of urn; annulus large, of 2–3 rows of cells; peristome teeth irregularly truncate, short, scarcely appearing above the annulus, sometimes perforate, papillose; spores about 10 μ in diameter, mature in spring.

Type locality, Hartz Mts., Germany.

ILLUSTRATIONS:—Web. & Mohr, l. c. *pl. 4;* Bry. Eur. *pl. 115;* Braithw. Brit. Moss Fl. **1**: *17D; Pl. 36.*

Rare, and known in N. America from trap dykes in Tuckerman's Ravine, Mt. Washington, New Hampshire only. More common in mountains of British Isles and continental Europe.

This species and its relatives in the *Ditrichaceae* approach *Campylostelium* in the *Grimmiaceae*, while *Ditrichum* approaches *Barbula* in the *Pottiaceae.*

3. BLINDIA Bry. Eur. fasc. 33–36. 1846.

Plants large for the family; stems freely branching, with central strand; leaves lanceolate from a sheathing base; cells of basal angles inflated and forming auricles as in *Dicranum;* costa percurrent, of uniform cells; seta long-exserted; calyptra cucullate; capsules globose-pyriform to turbinate; peristome teeth 16, entire, smooth, often perforate; annulus lacking.

Type species, *B. acuta.*

1. BLINDIA ACUTA (Hedw.) Bry. Eur. l. c. *pl. 114.*

Weisia acuta Hedw. Sp. Musc. 71. 1801.
Blindia acuta flexipes R. & C. Rev. Bryol. **19**: 79. 1892.
Blindia flexipes Kindb. Eur. & N. Am. Bryin. 214. 1897.

Plants loosely cespitose, light to dark green, stems 1–8 cm. high; leaves crowded, suberect to slightly secund, 2–3 mm. long, lance-subulate from a broader sheathing base; upper and perichaetial more abruptly narrowed from an ovate base, concave, with entire incurved margins; costa strong, filling all the upper awn, sometimes slightly toothed at apex; basal cells linear, incrassate, those at insertion shorter and often colored, alar quadrate to short-rectangular and inflated, more highly colored. Dioicous; seta 3–10 mm. long, straight or curved; capsule pyriform, turbinate when dry and empty, with a short stomatose neck; urn with neck about 1 mm. long; exothecial cells small, irregular and thick-walled; operculum conic-rostrate; peristome teeth bright red, sometimes perforate and split at the apex; spores smooth, 10–18 μ in diameter, mature in early summer.

Type locality, Wales.

ILLUSTRATIONS:—Bry. Eur. l. c.; Limpr. Laubm. **1**: 474. *f. 149;* Braithw. Brit. Moss Fl. **1**: *pl. 17F;* M. H. M. *f. 41.*

EXSICCATI:—Drumm. Musc. Am. 72; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 113; Aust. Musc. Appal. Suppl. 484; R. & C. Musc. Am. Sept. 362; Holz. Musc. Acro. Bor. Am. 11, 179; Grout, Musc. Perf. 120.

On wet rocks and ledges in cool moist elevated places; Greenland to Alaska, south to Vermont, New York, Michigan, Minnesota and Oregon.

Family DICRANACEAE.

Plants large to very small, usually growing in close sods or broad mats; stems mostly branching dichotomously, with central strand, for the most part densely leafy, usually more or less tomentose or radiculose; leaves straight and erect to curved and secund, sometimes crispate, smooth in the larger number of species, but often mamillose to papillose on one or both faces, for the most part broadly to narrowly lanceolate, often with a clasping base; costa of heterogenous cells (except subgenus *Arctoa* of *Dicranum*), usually mostly percurrent to excurrent, sometimes strongly ribbed on the back; alar cells strongly differentiated in many species, in others not at all; other basal cells usually elongated, the upper shorter, often isodiametric; cell walls often thickened and pitted. Dioicous or monoicous; seta much longer than the perichaetial leaves, erect or curved; capsules from erect and symmetric to arcuate and cernuous, sometimes plicate or strumose; peristome teeth single, rarely lacking, of 16 teeth from a low basal membrane, usually divided more than ½ the way down into two slender lanceolate to linear prongs, usually longitudinally striate below, often papillose above; operculum mostly rostrate; calyptra cucullate, never plicate or hairy, sometimes ciliate at base, often rough at apex.

Forms without split teeth are much like the *Seligeriaceae*, but such forms usually lack the strongly awned leaves. Species with awned leaves usually have split peristome teeth. The key will be given at the end of the family.

1. DICRANELLA Schimp. Coroll. Bry. Eur. 13. 1855.

Angstroemia C. Muell. Syn. **1**: 430. 1848. (in part).
Anisothecium Mitt. Jour. Linn. Soc. **12**: 39. 1869.
Microdus Schimp.; Besch. Mém. Soc. Sci. Nat. Cherb. **16**: 161. 1872.

Mostly small, earth-growing plants, gregarious or in wide close sods; stems erect or ascending, simple or branching, sparsely radiculose below; leaves smooth, smaller below and often rather distant, crowded above, straight and erect-appressed to spreading-squarrose or secund; abruptly subulate from a sheathing base to gradually narrowed from a non-sheathing base, mostly entire except at or near the apex; costa strong, mostly percurrent or excurrent, often filling the upper part of the leaf, sometimes vanishing 5 or 6 cells below the leaf apex, occasionally rough on the back near the apex; leaf cells subquadrate to linear, sometimes thick but not pitted; the basal longer and more clear, alar not differentiated (slightly so in *D. squarrosa*). Mostly dioicous; seta mostly erect and straight, yellowish when young, often dark red with age; capsule globose to oblong-cylindric, erect or cernuous, symmetric or often curved and strumose, smooth or plicate when dry

and empty; annulus large to wanting; peristome of 16 teeth, reddish mostly divided below the middle into two, rarely three, papillose prongs, usually vertically striate in the undivided part.

Type species, *Dicranella Grevilleana.*

KEY.

1.	Stem leaves squarrose from an enlarged, often clasping base	2.*
	Stem leaves not squarrose, without enlarged clasping base	5.
2.	Costa 40–60 μ wide, about 1/6 width of leaf base; leaves not long-decurrent	3.
	Costa about 50 μ wide, about 1/20 width of leaf base; leaves long-decurrent	*3. squarrosa.*
3.	Costa smooth on the back	4.
	Costa toothed on the back above	*1. Schreberi.*
4.	Capsules erect and symmetric; annulus present	*8. crispa.*
	Capsules inclined and unsymmetric; annulus lacking	*2. Grevilleana.*
5.	Leaves mostly with blunt rounded apex and costa clearly vanishing below it	6.
	Leaves mostly with acute apex and costa nearly percurrent to excurrent	7.
6.	Leaf apex dentate; median leaf cells quadrate to short-rectangular	*6. Hilariana.*
	Leaf apex mostly entire; median leaf cells 2–6 : 1	*7. Herminieri.*
7.	Capsules distinctly strumose	*11. cerviculata.*
	Capsules not distinctly strumose	8.
8.	Capsules erect and symmetric or nearly so	9.
	Capsules cernuous and unsymmetric	10.
9.	Capsules strongly plicate when dry and empty, with mouth oblique	*12a.* var. *orthocarpa.*
	Capsules nearly or quite smooth when dry and empty	*5. rufescens.*
10.	Capsules plicate when dry and empty	11.
	Capsules smooth or slightly wrinkled and mouth not oblique when dry and empty	*4. varia.*
11.	Mouth of empty capsules oblique; annulus poorly developed	*12. heteromalla.*
	Mouth of capsule not oblique; annulus well developed	12.
12.	Awn of two or three inner perichaetial leaves much shorter than the clasping base or sometimes lacking on the innermost	*10. stickinensis.*
	Awn of inner perichaetial leaves usually more than twice the length of the broad, less clasping base	*9. subulata.*

1. DICRANELLA SCHREBERI (Sw., Hedw.) Schimp. Coroll. Bry. Eur. 13. 1855.

Dicranum Schreberianum Hedw. Sp. Musc. 14. 1801.
Cynodontium canadense Mitt. Jour. Linn. Soc. 8: 17. 1864.
Dichodontium canadense Lesq. & James, Man. 62. 1884.

Plants in bright to yellowish green tufts, 1–3 cm. high; lower leaves smaller, the upper larger, from a broad half-sheathing base gradually narrowed to a squarrose subulate-lanceolate limb, serrulate above, mostly acute; margins plane, sometimes serrulate to well below the middle; costa nearly percurrent to excurrent, about 50 μ wide; leaf cells in the upper part 6–12 μ wide and 2–3 : 1, mostly rectangular, shorter on the outer shoulders and much longer in the basal portion, 6–10 : 1 perichaetial leaves the longest, reaching 3.5 mm. long, clasping at base and more abruptly narrowed to the squarrose limb. Seta up to 1 cm. or more in length, erect, flexuous; capsule short-oblong, curved and cernuous, *smooth, not strumose*, contracted under the mouth when dry, urn 0.8–1.4 mm. long; operculum beaked, the beak usually little longer than the conical base; exothecial cells incrassate, oblong, 1–2 : 1; annulus lacking; peristome teeth red, usually divided about 1/3 the way down, longitudinally striate below, 0.4–0.5 mm. long, united at base; spores up to 18 μ in diameter, mature in autumn.

Type locality, Sweden.

ILLUSTRATIONS:—Bry. Eur. *pl. 53;* Braithw. Brit. Moss Fl. **1:** *pl. 16E;* Limpr. Laubm. **1:***f. 114; Pl. 37.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 61.

On damp clayey soil in fields and on sides of ditches; Pennsylvania to Oregon and British Columbia, north to Hudson Bay.

*Often the leaves of *2* are not strongly squarrose but widely spreading.

Varying greatly in the length, slenderness and amount of serration of the leaves, length of urn and operculum. The plants with long, slender and less serrulate leaves and longer leaf cells were called var. *occidentalis* by Austin, Bull. Torr. Club **6:** 344. 1879. This form is represented by Drumm. Musc. Am. 97 & Holz. Musc. Acro. Bor. Am. 152.

1a. Var. ELATA Schimp. Syn. (Ed. 2) 72. 1876.

Var. *lenta* (Wils.) Limpr. Laubm. **1:** 318. 1886.

Plants almost exactly resembling in appearance a depauperate *D. squarrosa*. Leaves short, broader at the apex, strongly serrate; leaf cells broader and shorter. Lake Mara, Sycamous, British Columbia, July 7, 1889 (Macoun).

ILL. Braithw. l. c. *f.* β.

Probably *D. Grevilleana* is best regarded as a subspecies of *D. Schreberi* because intergrading forms are frequent. Such forms are represented by Holz. Musc. Acro. Bor. Am. 588 and Macoun's New Brunswick plants.

2. DICRANELLA GREVILLEANA (Brid.) Schimp. Coroll. 13. 1855.

Dicranum Schreberi Grevilleanum Brid. Bryol. Univ. **1:** 450. 1826.
Dicranum Grevilleanum Bry. Eur. fasc. 37–40. *pl. 54.* 1847.
Anisothecium Grevillei Lindb. Utkast 33. 1878.

Differs from *D. Schreberi* in the less strongly squarrose leaves, nearly or quite entire, more abruptly contracted into a narrower flexuose awn, sometimes faintly toothed at apex. Capsules faintly striate when dry and empty, slightly strumose, beak of operculum about twice as long; spores up to 17 μ, mature in summer.

Type locality, Scotland.

ILLUSTRATIONS:—Bry. Eur. l. c.; Braithw. Brit. Moss Fl. **1:** *pl. 16D;* Dixon, Handb. Brit. Mosses (Ed. 3) *pl. 11D; Pl. 37.*

EXSICCATI:—Macoun, Can. Musci 482; Holz. Musc. Acro. Bor. Am. 458, 588; Grout, Musci Perf. 137.

On damp soil in alpine regions; Idaho, Montana and Washington and north to Behring Sea. Macoun's plants from New Brunswick seem to belong to *D. Schreberi.*

3. DICRANELLA SQUARROSA (Schrad.) Schimp. Syn. (Ed. 1) 71. 1860.

Dicranum squarrosum Starke, Jour. Bot. Schrad. **2:** 435. 1801.

Also placed in *Oncophorus* by Bridel, *Angstroemia* by C. Mueller, *Dichodontium* by Schimper, *Diobelon* by Hampe and *Anisothecium* by Lindberg and others.

Plants robust, light- or yellowish-green, cespitose, up to 10 cm. high; fertile 3–5 cm.; stems mostly simple; stem leaves strongly squarrose from a loosely clasping base, strongly decurrent, the sheathing base oblong, slightly narrowed to the lanceolate-oblong, concave limb, broadly obtuse and rounded to obtusely acute at the apex; margin often somewhat wavy and crenulate at the apex, plane; costa just above the base 50–65 μ wide, vanishing below the apex; leaf cells irregularly rectangular to oblong-hexagonal, median 8–15 μ wide, 40–65 μ long; basal cells about twice these dimensions; perichaetial leaves similar, the clasping base of the inner relatively longer. Seta reddish, erect, 1–1.5 cm. long; capsule obovoid to short-oblong, cernuous, unsymmetric, not strumose, brown, smooth; urn 1.5–2 mm. long; operculum long-conic, ⅔ length of urn; annulus lacking; peristome teeth dark red, reaching 0.45–0.7 mm. long, divided ⅓–½ the way down into 2–3 densely papillose prongs, striate below, from a basal membrane 3–4 cells wide; spores about 18 μ in diameter, maturing in autumn.

Type locality, European.

ILLUSTRATIONS:—Bry. Eur. *pl. 52;* Braithw. l. c. *pl. 16F; Pl. 37.*

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 162, (Ed. 2) 245, both as *Meesia longiseta* var.

On wet gravelly soil in and near streams and bogs; Greenland, New Brunswick, Ontario, British Columbia and Alaska; south to New Hampshire and the Cascade Mts. of Washington. The Washington plants are the only ones found fruiting in N. America.

3a. Forma FLUITANS **n. f.**

Plantae semi-fluitantes, 8–10 cm. longae; folia 1.4 mm. longa, lanceolato-lingulata, prope recta, e basi non amplectente.

Plants in loose semi-floating masses, 8–10 cm. long; leaves erect-open, not clasping at base, nearly straight, lingulate-lanceolate, about 1.4 mm. long. Type, Grout, N. Am. Musci Pl. 458, Cape Breton Id. (Nichols).

Mr. H. N. Dixon was the first to place this anomalous form. Plants approaching it have been collected at Mt. Desert Id. and Franklin Co. Maine, but in these the leaves are subclasping and widely spreading.

4. DICRANELLA VARIA (Hedw.) Schimp. Coroll. Bry. Eur. 13. 1855.

Dicranum varium Hedw. Sp. Musc. 133. 1801.
Anisothecium rubrum Lindb. Utkast 33. 1878.
Dicranella Langloisii R. & C. Bot. Gaz. **15**: 39. *pl. 5A*. 1890.
Dicranella Howei R. & C. Bull. Herb. Boiss. **4**: 15. 1896.
Dicranella chrysea C. Muell. Hedwigia **37**: 230. 1898.

Plants gregarious or loosely tufted, dull- to bright-green; stems usually branched, 5–10 mm. long, sometimes more; lower leaves about 1 mm. long, erect-spreading or somewhat secund, long-lanceolate, the upper 1.5–2 mm. long, denticulate at apex, which is slender and acute to narrowly obtuse; upper lamina plane and bistratose; margin often recurved below; costa relatively large, about ⅕ the width of leaf at the base, nearly percurrent to slightly excurrent; median leaf cells linear to narrowly rectangular; 4–6 μ wide and 4–10 : 1; in the lower leaves 8–12 μ wide and 2-4 : 1; in the lower leaves of old stems, the leaves of young stems and the lower cells of all leaves about the same; perichaetial leaves the largest, broader and half sheathing at base. Dioicous; seta erect, 5–10 mm. long, reddish; capsule ovoid to short-oblong, more or less inclined and curved, when dry and empty smooth and markedly contracted below the mouth, not strumose; urn up to 1 mm. long, usually shorter; operculum rostrate; annulus lacking; peristome teeth red, up to 0.4 mm. long, longitudinally striate below, above papillose and divided ⅛–½ the length; spores finely papillose, about 18 μ in diameter, mature in late autumn.

Type locality, England.

ILLUSTRATIONS:—Bry. Eur. *pl. 57, 58;* Braithw. l. c. *pl. 16B;* M. H. M. *pl. 13*.

EXSICCATI:—Drumm. Musc. Am. S. States 50; Sull. Musc. Allegh. 164; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 47, (Ed. 2) 63; Aust. Musc. Appal. 78; Holz. Musc. Acro. Bor. Am. 151 (as *D. rufescens*), 30, 532; Baker, Pacific Coast Bryophytes 287; Grout, Musci Perf. 145.

Moist clay soil, banks of ditches and sometimes crevices of rocks. New Brunswick to Alaska and south to Mexico, Florida and Cuba; frequent.

The species is exceedingly variable in a number of characters but they are so little correlated that it is difficult to distinguish varieties. Some leaves may be filiform and with 2–3 teeth at the apex, otherwise entire; others may be narrowly obtuse and with several teeth at the blunt apex and distantly and finely toothed half way to the broader base; leaf margins revolute nearly to apex or rarely almost plane. Leaves of sterile plants are often triangular-lanceolate with leaf cells broader and about 2–3 : 1. The capsules are occasionally erect and symmetric, but others in the same tuft will have longer curved capsules; the operculum may be long conic to rostrate with beak as long as the conic part.

Holzinger, Bryol. **28:** 34 reports *D. humilis* Ruthe, Hedwigia **12:** 147. 1873 from Wisconsin (Musc. Acro. Bor. Am. 532). Dixon, according to Holzinger, regards *D. humilis* as equivalent to *D. varia* var. *tenella* (Bry. Eur.) Schimp.; Dixon, Handb. Brit. Mosses (Ed. 3), describes it as follows, "*Slender;* leaves usually falcate, *narrower*, areolation thin-walled, *laxer*, margin hardly recurved, remotely denticulate."

Limpricht says (Laubm. **1:** 323) that *D. humilis* is intermediate between *D. varia* and *D. rufescens* but nearer the latter.

Holzinger's 532 has narrower leaf cells than Rabenhorst's 1221, *D. humilis*, but may well be referred to it.

5. DICRANELLA RUFESCENS (Dicks., Sm.) Schimp. Coroll. Bry. Eur. 13. 1855.

Dicranum rufescens Sm. Engl. Bot. *pl. 1216;* 1803.
Anisothecium rufescens Lindb. Utkast 33. 1878.

Plants gregarious or in loose sods, often brownish or reddish; stems slender, little branched, up to 15 mm. high; lower leaves rather distant, spreading, the upper closer, longer, often somewhat secund, reaching 1 mm. long, narrowly lanceolate, acute ending in one cell, or more obtuse ending in 3–4 cells; margin plane,

entire except at apex or often faintly and distantly denticulate in the upper half; costa about 40 μ wide at base, nearly or quite percurrent in the *upper* leaves; leaf cells thin-walled, narrowly rectangular or with oblique end-walls, 6–8 μ wide up to 10 : 1, the marginal row often wider; perichaetial leaves similar but with a broader base, and longer reaching 1.75 mm. Seta red-brown, erect, 4–8 mm. long; capsule ovoid, erect, symmetric, smooth or slightly wrinkled and contracted below the mouth when dry and empty; urn 0.6–1 mm. long; annulus lacking; operculum long-conic to short-rostrate, ½–⅔ the length of the urn; peristome red, large, about 0.3 mm. long, divided nearly or quite ½ way down, striate below, strongly papillose above; spores slightly rough, 12–16 μ, mature in late autumn.

Type locality, England.

ILLUSTRATIONS:—Bry. Eur. *pl. 59;* Braithw. l. c. *pl. 16C;* M. H. M. *pl. 12.*

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 48, (Ed. 2) 64; Aust. Musc. Appal. 74; Holz. Musc. Acro. Bor. Am. 505.

On moist shaded soil mostly bare of other vegetation; New Brunswick and Ontario to Alaska, south to Virginia and Washington, reported from Oregon. Apparently infrequent.

The western form represented by Holzinger's 505 has the cells of the upper lamina less distinctive in that they are narrower and less pellucid.

6. DICRANELLA HILARIANA (Mont.) Mitt. Jour. Linn. Soc. **12:** 31. 1869.

Dicranum Hilarianum Mont. Ann. Sci. Nat. II. **12:** 52. *pl. 1. f. 3.* 1839.
Dicranum debile Wils. in Drumm. Musc. Am. S. States 51. 1841.
Dicranum tenuirostre Kunze; Schwaegr. Suppl. **4:** *pl. 108a.* 1842.
Angstroemia Liebmanniana C. Muell. Syn. **2:** 605. 1851.
Dicranella Liebmanniana Mitt. Jour. Linn. Soc. **12:** 32. 1869.
Campylochaetium mexicanum Besch. Mém. Soc. Sci. Cherb. **16:** 168. 1872.
Angstroemia mexicana C. Muell. Linnaea **38:** 630. 1874.
Angstroemia trematodontifolia C. Muell, l. c.
Dicranella debilis Lesq. & James, Man. 66. 1884.
Dicranella leptorhyncha R. & C. Bull. Soc. Bot. Belg. **31**[1]**:** 143. 1893.
Dicranella laxiretis R. & C. Rev. Bryol. **20:** 30. 1893.
Angstroemia pseudo-debilis C. Muell. Hedwigia **37:** 229. 1898.
?*Angstroemia Wrightii* C. Muell. Hedwigia **37:** 229. 1898.
Microdus cubensis Paris, Index Bryol. (Ed. 1) Suppl. 244. 1900.
Microdus debilis Besch.; Paris, Index Bryol. (Ed. 2) **3:** 236. 1905.
Microdus laxiretis Paris, Index Bryol. (Ed. 2) **3:** 237. 1905.

Plants in loose mats; stems 2–5 mm. long, simple or branching by innovations; stem leaves erect-spreading when moist, often somewhat secund, the upper larger, reaching 2 mm. in length, narrowly long-lanceolate, *gradually narrowed to a blunt serrulate apex,* sometimes subacute or nearly entire, concave, with the margins more or less recurved and serrulate below the apex; costa stout, occasionally rough on the back at the apex, ending below the apex; upper leaf cells subquadrate to short-rectangular, the lower much longer and clearer, 6–10 μ wide, 2–3 : 1; perichaetial leaves little different. Seta flexuous, 5–10 mm. long, yellowish when young, brownish when old; capsule nearly or quite erect, ovoid to short-oblong, light brown, becoming darker with age and oblong-cylindric when empty, slightly or not at all contracted under the mouth; operculum long-rostrate, nearly as long as the urn; annulus large; urn about 1 mm. long; exothecial cells hexagono-rectangular, 20–30 μ wide, 1–2 : 1; peristome teeth reaching 0.2 mm. in length, divided ⅔–¾ of the way, vertically striate below, papillose in indistinctly spiral lines above; spores finely papillose, 15–18 μ in diameter, mature in spring.

Type locality, southern Brazil.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 20;* Bot. Gaz. **30:** *pl. 3. f. 2; Pl. 38.*

EXSICCATI:—Drumm. Musc. Am. S. States 51; Grout, Musci Perf. 73 (as *D. Herminieri*).

Southern U. S. to South America; common in peninsular Florida on moist banks of ditches.

The synonymy of this species and indeed of the Dicranaceae as a whole is based on Williams' treatment in the North American Flora **15**[2].

Of this species Williams remarks "The specimens included here under *D. Hilariana* are somewhat variable. The variation consists chiefly in the length of the upper leaves, the width of the leaf apex, and the amount of serration on the leaf border above and on the back of the costa near its termination. In all of the specimens at least some of the leaves have a rounded-obtuse, crenate or dentate apex."

7. DICRANELLA HERMINIERI Besch. Ann. Soc. Nat. VI. 3: 180. 1876.

Dicranella Tonduzii R. & C. Bull. Soc. Bot. Belg. 31[1]: 144. 1893.
Dicranella leptotrichoides R. & C. Bot. Gaz. 19: 237. *pl. 21A*. 1894.
Angstroemia hydrophila C. Muell. Hedwigia 37: 230. 1898.
Microdus hydrophilus Paris, Index Bryol. Suppl. 245. 1900.
Dicranella substenocarpa R. & C. Bull. Soc. Bot. Belg. 41[1]: 11. 1905.
Microdus leptotrichoides Paris, Index. Bryol. (Ed. 2) 3: 237. 1905.

Plants in size, habit and general appearance much like the last; leaves broader at the base and mostly narrower at the apex, averaging a little shorter, nearly or quite entire at apex; upper median leaf cells 4–7 μ wide, *2–6 : 1, narrowly rectangular to oblong-linear*, rather obscure, the lower cells larger, thinner-walled and clear, sometimes colored. Seta yellowish, turning dark with age, 6–9 mm. long; capsule ovoid, erect, symmetric, brown, becoming darker and oblong with age; peristome and spores about as in the preceding.

Type locality, Guadeloupe.

ILLUSTRATIONS:—Bot. Gaz. l. c.; *Pl. 37*.
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 46b, (Ed. 2) 62; Aust. Musc. Appal. 468; Holz. Musc. Acro. Bor. Am. 129; Sull. Musc. Allegh. 177 (as *Trichostomum tenue*); Grout, Musci Perf. 71 (as *D. subinclinata*).

Moist banks and sides of ditches; South Carolina to Florida and Louisiana. Abundant in peninsular Florida and mixed with the last. Williams, l. c., p. 85, states that *Dicranella compacta* (Schimp.) Mitt. Jour. Linn. Soc. 12: 37. 1869 is probably also a synonym and if so should replace the present name. Later he has expressed in a letter the doubt that *D. Herminieri* and *D. subinclinata* are distinct. If they are synonyms, then several others should be added to the list given above. The length and narrowness of the upper leaf cells varies greatly even on the leaves of the same plant. Thus far the plants I have seen from the U. S. correspond nearly to the above description and have seemed to be all one specific type. The stem leaves of this species are remarkably like those of *Ditrichum pusillum*. In some plants the leaves are almost triangular-lanceolate and these have shorter and broader leaf cells throughout, but these short cells are occasionally found in the leaves of the usual shape and are always in the shorter lower leaves. The leaf cells of *D. leptotrichoides* in the Bot. Gaz. plate are very inaccurately drawn.

8. DICRANELLA CRISPA (Hedw.) Schimp. Coroll. Bry. Eur. 13. 1855.

Dicranum crispum Hedw. Sp. Musc. 132. 1801.

Plants in small loose, yellowish tufts, reaching 1 cm. high, mostly less than 5 mm.; stems more or less branching; leaves rather distant, the lower much smaller, crisped-flexuose, spreading when moist, from a broad half-sheathing base abruptly to gradually narrowed to a slender, almost linear awn, 2–3 times the length of the base, acute at the apex; margins incurved, entire except at the apex; costa percurrent to excurrent; cells of the upper lamina linear, about 5 μ wide, up to 60 μ or more long, those of the base a little longer and about 12 μ wide; perichaetial leaves up to 3 mm. long, sheathing at base and more abruptly narrowed, often crenulate on the margin at the shoulder. Dioicous or occasionally with a short antheridial branch below the perichaetium; seta 1–1.8 cm. long, reddish; capsule *obovoid, short, thin-walled, when dry and empty obconic to turbinate, deeply and regularly striate, erect and symmetric;* urn about 0.75 mm. long; operculum nearly as long, with beak oblique or straight; exothecial cells incrassate, irregular, 2–3 : 1, a narrow band of smaller dark red cells about the mouth; annulus present, well developed; peristome teeth red, split nearly to the middle, up to 350 μ long, longitudinally striate below, papillose and paler at the apex; spores only slightly papillose, 17–20 μ, mature in late summer.

Type locality, Sweden.

ILLUSTRATIONS:—Bry. Eur. *pl. 504;* Limpr. Laubm. 1: 321. *f. 115;* Braithw. l. c. *pl. 15D; Pl. 37*.
EXSICCATI:—Drumm. Musc. Am. 102; Macoun, Can. Musci 504; Holz. Musc. Acro. Bor. Am. 587.
On moist sandy soil; Montana and Idaho to the Arctic; rare.

9. DICRANELLA SUBULATA (Hedw.) Schimp. Coroll. 13. Bry. Eur. 1855.

Dicranum subulatum Hedw. Sp. Musc. 128. *pl. 34, f. 1–5*. 1801.
Dicranella secunda (Sw. 1795) Lindb. Musc. Scand. 26. 1879.

Plants in silky tufts, 0.5–2 mm. high; leaves flexuose, erect-spreading to more or less secund, the upper 2–3 mm. long, from an ovate-lanceolate subclasping base gradually narrowed to a channelled filiform awn,

entire or somewhat denticulate at and near apex; costa 40–45 μ wide at base, excurrent, sometimes longly so; *margins plane; upper leaf cells narrowly linear, 3–4 μ wide and up to 10 : 1,* basal twice as wide, a few shorter irregular cells at the shoulder; perichaetial leaves usually the longest, the inner shorter, *convolute-clasping, from an ovate or obovate base, abruptly to almost truncately narrowed to a filiform awn.* Seta red, 10–15 mm. long; capsule ovoid to short-oblong, mostly *inclined, curved and unsymmetric, not strumose, plicate when dry;* urn 0.8–1.2 mm. long; operculum long-rostrate, more than ½ the length of the urn, often equalling it; exothecial cells irregularly oblong, 1–3 : 1, with thick sinuous walls; annulus double; peristome teeth dark red-brown, about 350 μ long, split nearly ½ the way down, striate below, finely papillose above; spores finely papillose, 18–24 μ in diameter; mature late summer to autumn.

Type locality, Sweden.

ILLUSTRATIONS:—Hedw. l. c.; Bry. Eur. *pl. 60;* Braithw. l. c. *pl. 15E: Pl. 37.*

EXSICCATI:—Drumm. Musc. Am. 98; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 50, (Ed. 2) 66; Aust. Musc. Appal. 469; Holz. Musc. Acro. Bor. Am. 305.

Moist stony soil in cool or elevated regions; from subarctic N. America south to New Hampshire (White Mts.) and California.

Holzinger's 305 from the White Mts. has the leaves almost squarrose and slightly toothed at the apex, but the capsules are curved and unsymmetric. Williams, N. Am. Flora **15**[2]: 87, includes *D. curvata* (Hedw.) Schimp. as a synonym of *D. subulata.* The chief distinctions given by European authors are the erect and symmetric capsule of *D. curvata* and its denticulate leaves. Denticulate leaves are certainly found with curved capsules and the erect capsules alone are not sufficient for a specific distinction in this group of *Dicranella.* Consequently I agree with Williams.

This is distinguished from the common *D. heteromalla* by the nearly smooth awn, the more finely ribbed capsule and perhaps the red seta.

I do not find the color of the seta a very useful diagnostic character in this genus as its color varies so with age. Sometimes young setae in this species are distinctly yellow.

10. DICRANELLA STICKINENSIS n. sp.

Plantae dense caespitantes, 2 cm. altae, inferne tomento humoque compactae; folia e basi latiore longe subulata, margine integra; costa valida in subulam validam excurrens; folia perichaetialia interiora obtusa vel cum subula brevi.

Plants in dense yellow-green sods reaching 2 cm. high, the basal part brown, dead and compacted with soil; stems freely branching by innovations; leaves 1–1.5 mm. long, subclasping at base, erect when moist, somewhat contorted in the upper part when dry, from a broader base gradually to rather abruptly contracted to a stout rigid entire awn; margins plane, entire; costa stout, percurrent to strongly excurrent in the upper and perichaetial leaves; perichaetial leaves from an ovate base abruptly contracted to a stout awn 1.5–2 times the length of the base in the outer, in the inner convolute-clasping with awn shorter than the base, or often the innermost broadly pointed and obtuse. Sporophyte like that of *D. subulata* except that the capsules are suberect and that the basal part of the peristome teeth is coarsely papillose, striate at base of forks; spores not fully developed, nearly smooth, up to 18 μ. Type from Stickine Glacier, British Columbia, Aug. 8, 1916 (W. S. Cooper). *Pl. 27B.*

Type in herb. A. J. G., cotypes at the N. Y. Botanical Garden and in herb. H. N. Dixon.

Except for the peristome markings the sporophyte would pass for the form of *D. subulata* that is sometimes called *D. curvata,* but the stem and perichaetial leaves are very different and remind one strongly of those of *Ditrichum lineare.*

11. DICRANELLA CERVICULATA (Hedw.) Schimp. Coroll. Bry. Eur. 13. 1855.

Dicranum cerviculatum Hedw. Sp. Musc. 149. 1801.
Dicranella polaris Kindb. Ottawa Nat. **5**: 195. 1892.
Dicranella pusilla (Hedw.) E. G. Britton, N. Am. Flora **15**[2]: 87. 1913.

Plants in dense yellow-green mats; stems simple, rarely over 1 cm. long; stem leaves erect-spreading, flexuous, more or less secund; upper stem leaves about 2 mm. long, half-sheathing at base, lanceolate-subulate, concave, channelled above, somewhat serrulate on the upper margin to almost entire; costa wide and strong, ⅓ the width of leaf base but not so clearly defined as in *D. heteromalla,* gradually wider to the shoulder of the leaf, then gradually narrowed and excurrent, denticulate at apex; upper cells of the narrow lamina 4–5 μ wide, 6–10 : 1, narrowly rectangular; basal nearly twice as large; cells of the lower leaves and of the

innovations much shorter, resembling those of *D. heteromalla;* perichaetial leaves larger with a broader more clasping base, more abruptly narrowed. Seta yellowish, 1 cm. or more in length; capsule short-ovoid, curved, inclined and unsymmetric, *plainly strumose,* faintly plicate when dry and empty, 1 mm. long, with a beaked operculum of an equal length; annulus imperfect, of a single row of inconspicuous cells remaining more or less attached to the operculum or urn; peristome teeth and exothecial cells as in *D. heteromalla;* spores 15–21 μ, mature late summer to autumn.

Type locality, Germany.

ILLUSTRATIONS:—Bry. Eur. *pl. 56;* Braithw. l. c. *pl. 16A;* M. H. M. *f. 40.*

EXSICCATI:—Sull. Musc. Allegh. 167; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 49, (Ed. 2) 65, 66 (in part); Holz. Musc. Acro. Bor. Am. 431.

On moist peaty banks and sides of ditches, bare moist soil, etc.

Arctic America to New York and New Jersey, west to British Columbia; rare.

11a. Var. AMERICANA Grout, M. H. M. 92. 1904.

Leaves more slender, neck of capsule slightly swollen, scarcely strumose; spores mature late autumn to winter. "Wet soil about iron deposit, Katahdin Iron Works, Maine, Nov. 5, 1898. (E. D. Merrill.)

This is probably the same as the European var. *pusilla* (Hedw.) Schimp. That is described as shorter with the leaves smaller and suberect. Which is not the case with the Maine plants, but the essential character seems to be the lack of the goiter.

12. DICRANELLA HETEROMALLA (Hedw.) Schimp. Coroll. Bry. Eur. 13. 1855.

Dicranum heteromallum Hedw. Sp. Musc. 128. 1801.
Campylopus Henrici R. & C. Bot. Gaz. 13: 197. 1888.

Plants usually in wide dark-green mats, sometimes yellowish; stems freely branched, usually by innovations, 1–4 cm. long; leaves usually falcate-secund, rarely erect-spreading, 2–4 mm. long, ovate-lanceolate to lanceolate, widest at insertion and gradually narrowed to a filiform rough channelled awn consisting chiefly of the stout, more or less excurrent costa, *which often occupies ⅓ the width of the leaf base and is rough on the back and sides from the middle of the leaf upwards,* rarely near the apex only; margins plane; cells at the leaf base rectangular, up to 12 μ wide, 2–6 : 1, the upper rectangular-oblong, narrower, 1.5–2 : 1; perichaetial leaves with a broader obovate clasping base, more abruptly narrowed to an awn 4–6 times as long as the clasping base and with lower cells larger than in the stem leaves. Seta erect or curved, 5–15 mm. long, rarely up to 3 cm., yellow when mature, sometimes dark red with great age; capsule more or less inclined and unsymmetric, ovoid to oblong-cylindric, *strongly sulcate only when dry and empty, with mouth oblique due to the capsules contracting below the mouth much more strongly on the under side;* urn 1–1.5 mm. long; operculum long-rostrate, about the same length; *annulus poorly developed;* exothecial cells, except at the mouth, oblong-flexuose, 2–5 : 1, incrassate; peristome teeth about 0.4 mm. long, dark red, typically divided to the middle, strongly striate longitudinally and papillose below, the prongs coarsely papillose and somewhat trabeculate; spores smooth, about 15 μ in diameter, mature autumn to winter.

Type locality England.

ILLUSTRATIONS:—Hedw. l. c. *pl. 30;* Bry. Eur. *pl. 62;* M. H. M. *pl. 11.*

EXSICCATI:—Drumm. Musc. Am. 95, 96; S. States 53, 54; Sull. Musc. Allegh. 165, 166; Sull & Lesq. Musc. Bor. Am. (Ed. 1) 51, (Ed. 2) 67; Aust. Musc. Appal. 79; Holz. Musc. Acro. Bor. Am. 6, 28, 530, 5 (as *D. cerviculata*); Grout, Musci Perf. 7; Allen, Mosses Cascade Mts. 11, 11a.

On moist banks in shaded places, very common; Newfoundland to Alaska, south to Florida, California and Central America.

The roughness of the back of the costa, the width and coarseness of the marginal serrations as well as their extent, vary greatly. Holzinger's 531, issued as var. *stricta,* has the leaves only a little less secund than usual, but the leaves are coarsely serrate and the serrations in diminished size extend well towards the broader base. This type of marginal lamina seems characteristic of the Pacific Coast plants.

The length of the leaves also varies considerably, those of the west averaging longer than those of the eastern plants. The seta nearly always appears lateral due to the innovations. The teeth of the peristome are very persistent but they gradually lose their markings of striae and papillae with age. In moist mountain regions the capsule is often tilted back on the curved seta so that the operculum is nearly vertical as shown in the Bry. Eur. plate *f. 1* & *15.*

12a. Var. SERICEA Schimp. Syn. (Ed. 2) 78. 1876.

Plants short, in bright green or yellowish tufts, soft and silky; leaves narrower, erect-spreading to subsecund. Not very distinct; occasional.

12b. Var. ORTHOCARPA (Hedw.) Paris, Index Bryol. 330. 1895.

Dicranum orthocarpum Hedw. Sp. Musc. 131. *pl. 30.* 1801.
Dicranella Fitzgeraldi R. & C. Bot. Gaz. **13:** 197. *pl. 13.* 1888.

Leaves shorter; capsules erect and symmetric or nearly so, with mouth little or not at all oblique when dry and empty; urn shrunken and coarsely furrowed rather than plicate when empty.

Type from Lancaster, Pennsylvania.

ILLUSTRATIONS:—Hedw. l. c.; Bot. Gaz. l. c.; M. H. M. *f. 39*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 52, (Ed. 2) 68; Aust. Musc. Appal. 80; Holz. Musc. Acro. Bor. Am. 128; Grout, Musci Perf. 143.

My remarks in M. H. M. p. 91, are in error, as the type is from the lowlands. The variety ranges from the Province of Quebec to Georgia and westwards to Indiana or farther. It is the common form along the Middle Atlantic seaboard, where in swampy woods it covers square feet in area. The stunted form found at the higher altitudes of the New England mountains does not, in my opinion, belong here. The capsules are usually more or less inclined and finely plicate when dry and empty. Their variations are due to habitat conditions. The frequent intergradations with the typical form do not indicate specific rank for this variety.

EXCLUDED SPECIES.

According to Williams, N. Am. Flora **15**^{2}**:** 93, the following should be excluded:

Dicranella cerviculatula Kindb. Ottawa Nat. **5:** 195. 1892, is *Dicranum hyperboreum* (Gunn.) Smith.

Dicranella parvula Kindb., Macoun, Bull. Torr. Club **16:** 91. 1889, is *Didymodon parvulus* (Kindb.) E. G. Britton.

PLATE I. *A. Andreaea rupestris*, var. β *acuminata* (from Bry. Eur. *pl. 624*). 1, 2, plants × 1; 3–6, stem leaves; *6a*, cells of leaf apex × 100; 7, 8, middle and inner perichaetial leaves respectively; 9, capsule; 10, calyptra.

B. Andreaea Blyttii (from Bry. Eur. *pl. 635*) 4–7, leaves much magnified; *4a*, *4b*, cells of apex and base respectively.

C. Andreaea rupestris var. *alpestris* (from Bry. Eur. *pl. 626*). 17, 21, leaves; *8a*, apical cells; *8bm*, basal marginal cells; *8bn*, basal median cells.

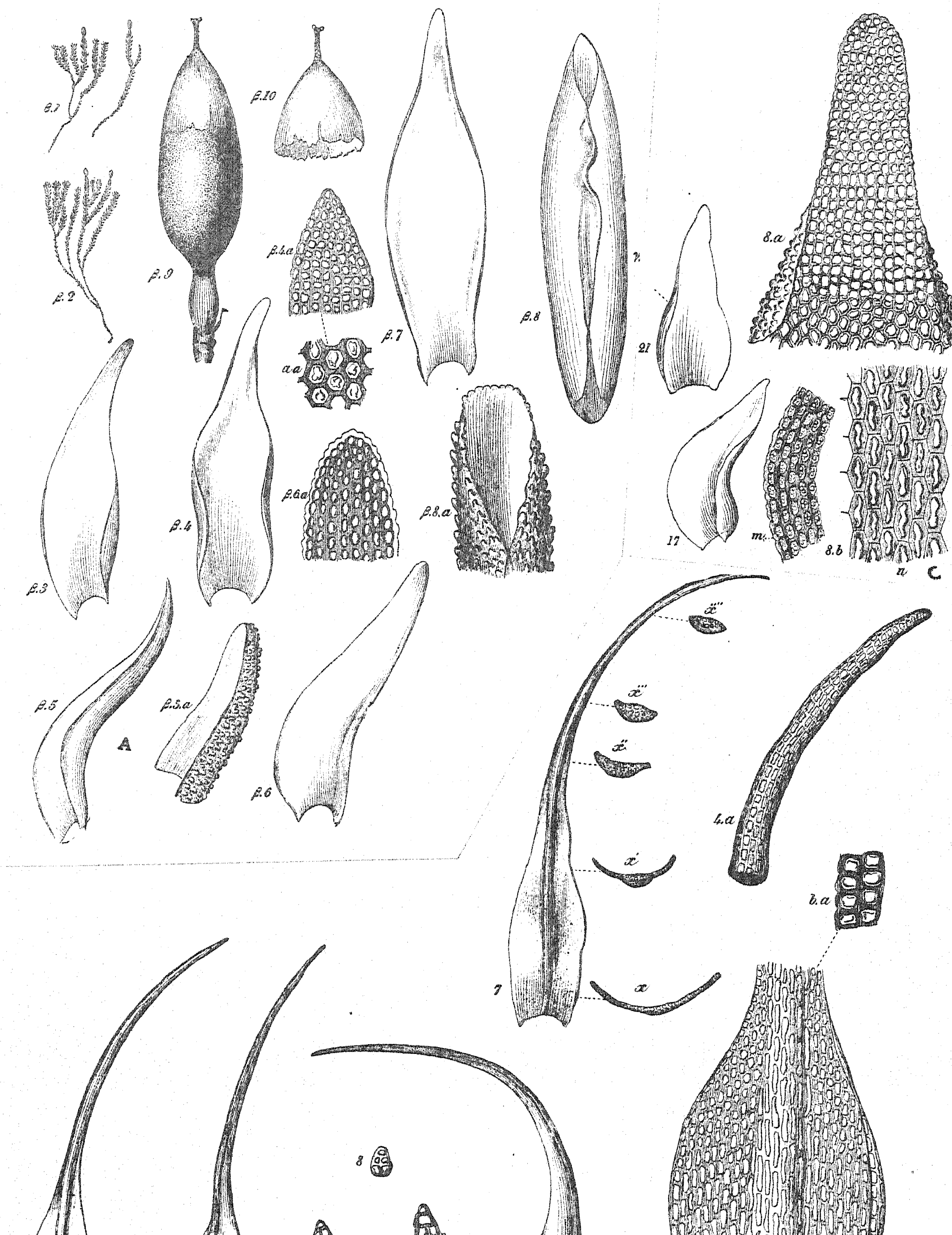


PLATE I.

Leich & Sowon & Sculp.

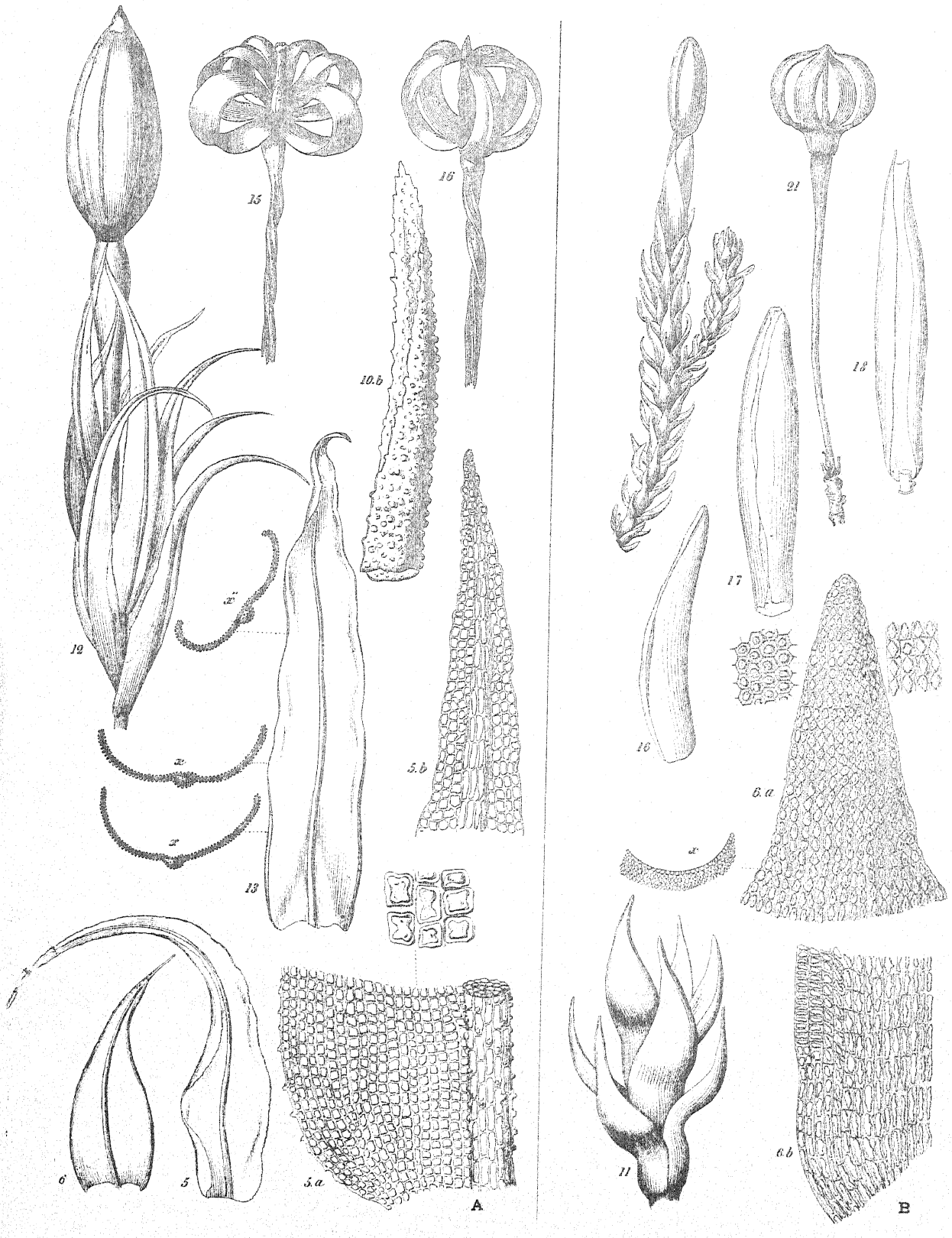


PLATE II.

PLATE 2. *A. Andreaea nivalis* (from Bry. Eur. *pl. 636*). 5, 6, leaves; 12, perichaetium with sporophyte; 13, perichaetial leaf; 5*a*, 5*b*, basal and apical cells respectively; *x*, cross sections of leaf; 10*b*, apex of leaf showing large papillae; 15, 16, open capsules.

B. Andreaea obovata (from Bry. Eur. *pl. 627*.) Upper left, part of fertile plant much enlarged; 16–18, perichaetial leaves; 11, portion of stem showing clasping leaf base; 6*a*, 6*b*, leaf apex and base showing cells; 21, open capsule.

PLATE 3. *Tetraphis pellucida.* (From Bry. Eur. *pl. 196.*) 1, 2, 3, plants × 1; 1*b*, fertile plant enlarged; 5, sterile plant bearing gemmiferous cups; 8, lower leaves; 9, upper median leaf; 12, 13, perichaetial leaves; 10*a*, apex of stem leaf; 15, capsule with calyptra; 17, deoperculate capsule showing peristome; 28, 29, gemmae; *x*, cross section of calyptra.

Tetraphis Browniana. (From Bry. Eur. *pl. 197.*) 1, 2, plants × 1; 3, frondiform leaves magnified; 4, a single one from 3 greatly magnified; 9, 10, 11, 12, perichaetial leaves; 15, capsule covered by the calyptra; 18, capsule; 19, peristome.

Tetraphis Browniana var. *repanda.* 1*b*, fertile plant enlarged, showing flagelliform branch; 4, flagelliform branch much enlarged.

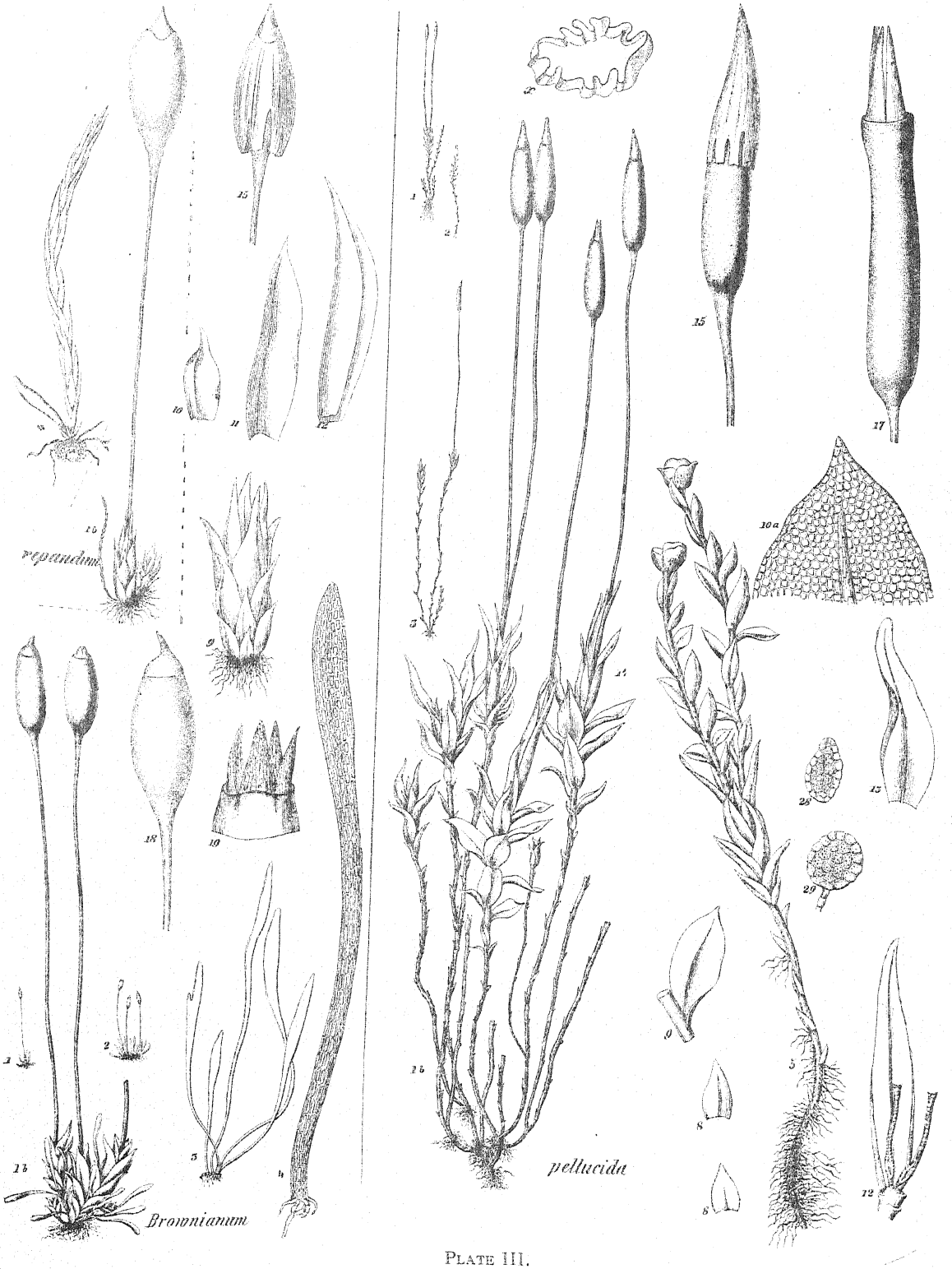


PLATE III.

PLATE IV.

PLATE 4. *A*. *Fissidens manateensis* (from micro-photographs by A. T. Beals). 1, portions of leaves and antheridial branch × 25; 2, plant with sporophyte × 4; 3, small plant with sporophyte beginning to show and with upper and perichaetial leaves in fine condition × 4.

B. *Tetraphis geniculata* (from Bry. Eur. Suppl., *Tetraphis*, *pl. 1*). 1, plants × 1; 2, upper part of plant enlarged; 4, 5, upper stem leaves; 6, perichaetial leaves; 8, leaf of sterile plant; 7*a*, 7*b*, areolation of apex and base of perichaetial leaf; 8*a*, areolation at apex of 8; 15, portion of seta much enlarged.

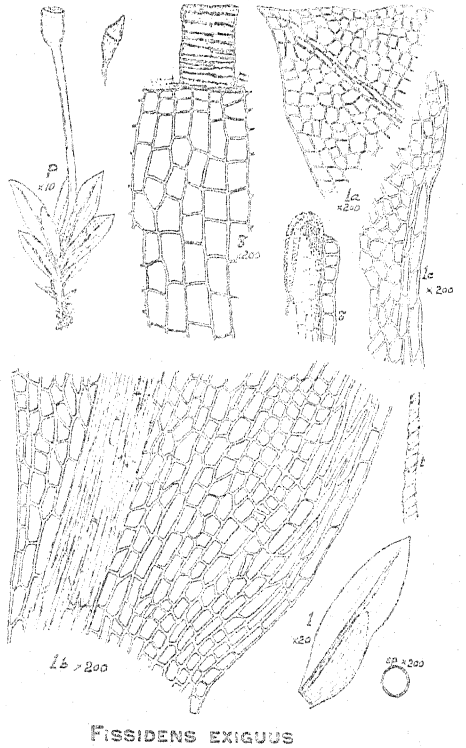
PLATE 5. *Fissidens exiguus* (from Jennings, Mosses W. Pa., *pl. 11*). P, plant enlarged; 1, leaf; 1*b*, cells of leaf base; 1*a*, cells of leaf apex; 1*c*, cells of margin of upper vaginant lamina; 8, exothecial cells with part of peristome tooth; *t*, upper part of a prong of tooth showing spiral thickening; *sp*, spore.

Fissidens bryoides var. *incurvus* (from Jennings l. c. *pl. 10* as *F. bryoides*). Description as for the preceding except that 1*b* shows the base of the dorsal lamina only.

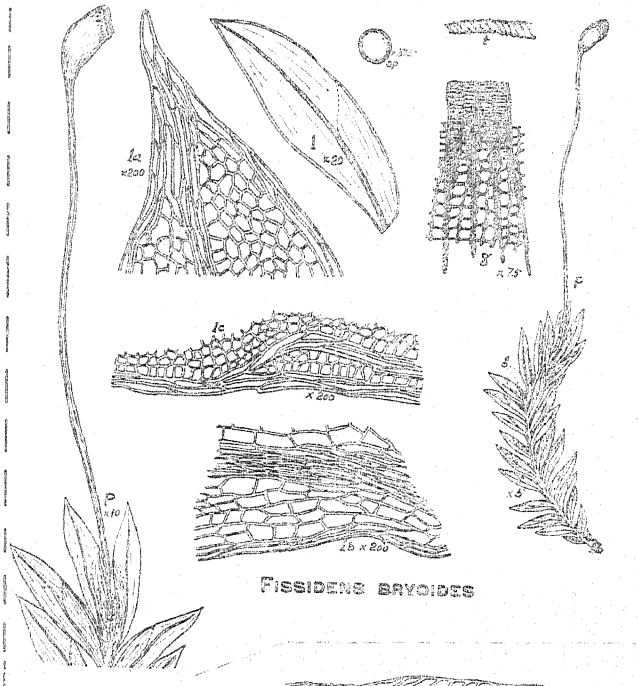
Fissidens minutulus (from Jennings l. c.). Description as for the preceding.

C. Fissidens viridulus (from Braithw. Brit. Moss Fl. **1**: *pl. 12**). *a*, plants × 1; *a**, same magnified; 1, leaf; 1*a*, leaf apex; 3, antheridial bud; 5, capsule.

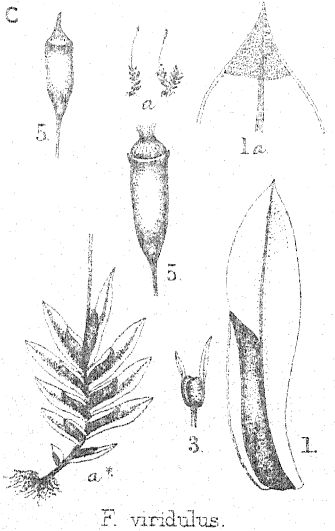
H. Fissidens viridulus var. *tamarindifolius* (from Braithw. l. c.). Description as for the preceding.



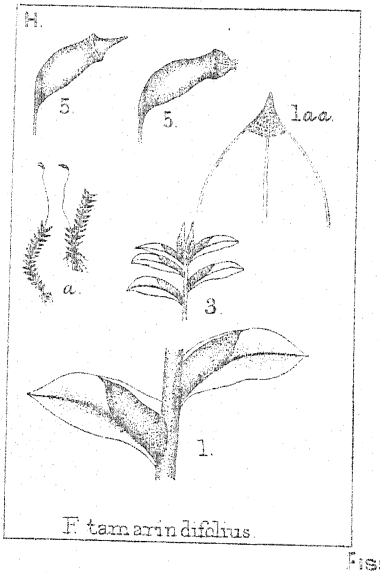
FISSIDENS EXIGUUS



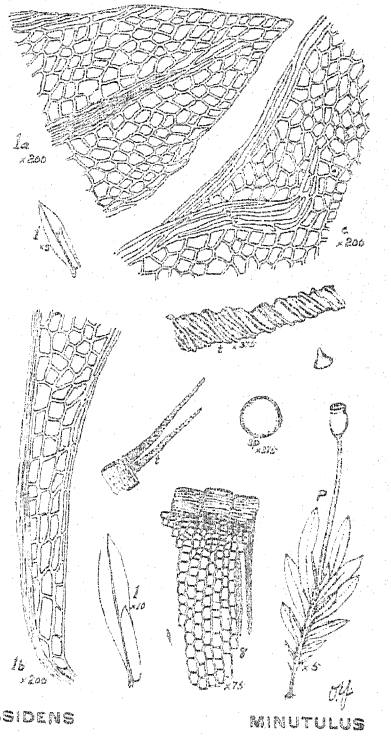
FISSIDENS BRYOIDES



F. viridulus.



F. tamarindifolius.



FISSIDENS MINUTULUS

PLATE V.

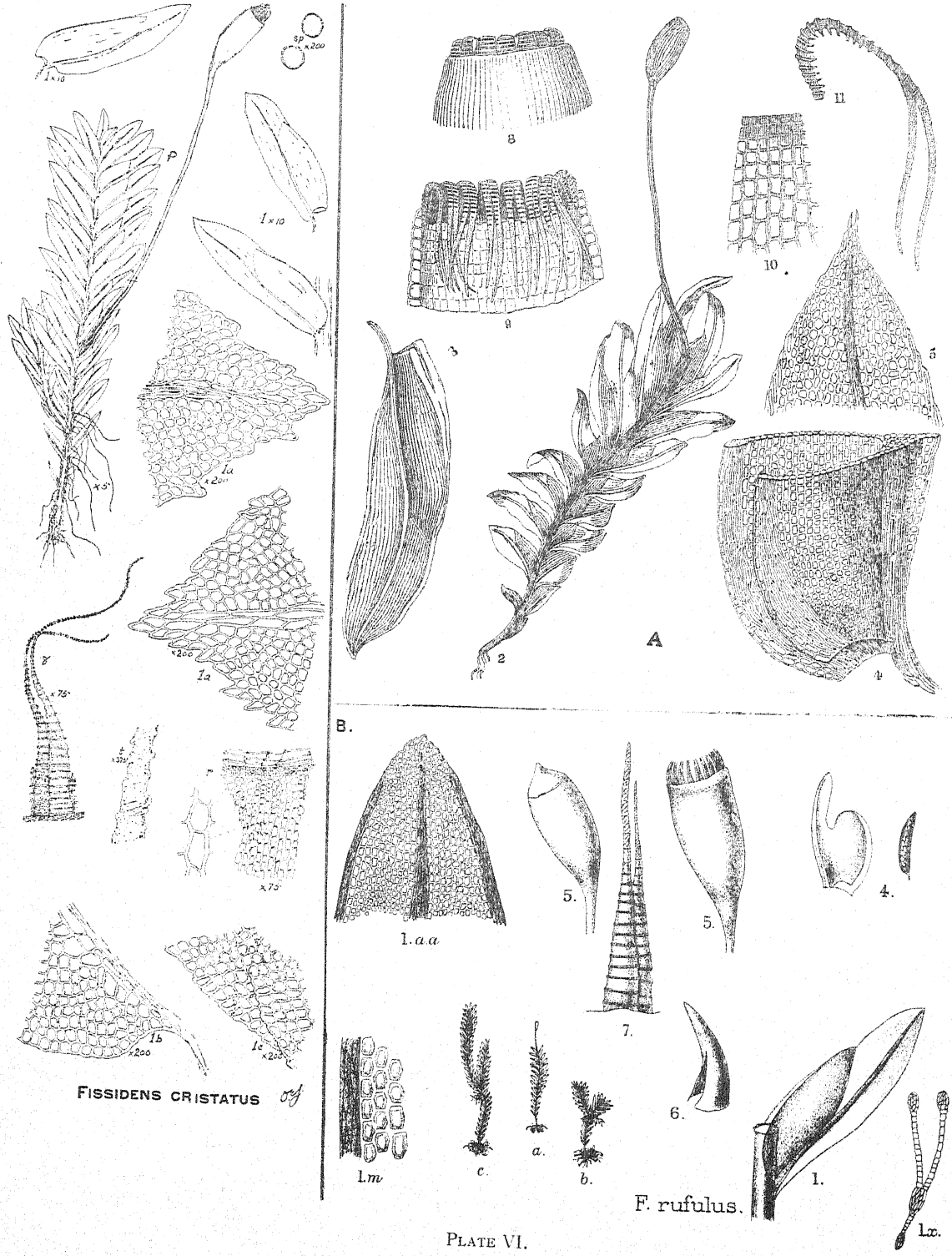


PLATE VI.

PLATE 6. *Fissidens cristatus* (from Jennings, Mosses of W. Pa. *pl. 11*). 1, leaves; 1*a*, leaf apices, 1*b*, base of dorsal lamina; 1*c*, leaf cells at summit of vaginant lamina; 8, tooth of peristome; *p*, entire plant; *r*, exothecial cells; *sp*, spores; *t*, portion of tooth showing spiral thickening.

A. *Fissidens limbatus* (from Sull. Pacific R. R. Reports **4**: *pl. 1*). 2, plant much enlarged; 3, leaf; 4, leaf base showing cells; 5, leaf apex; 8, 9, mouth of capsule showing the moist teeth infolded; 10, exothecial cells near the capsule mouth; 11, peristome tooth.

B. *Fissidens rufulus* (from Braithw. Brit. Moss Fl. **1**: *pl. 11B*). *a*, *b*, *c*, plants × 1; 1, leaf; 1*x*, cross section of same; 1*aa*, leaf apex; 1*m*, median cells near the costa; 5, capsules; 6, calyptra; 7, peristome tooth; 4, perigonial leaf and antheridium.

PLATE 7. *A*. *Fissidens Garberi*. 1, plant slightly enlarged; 2, plant × 10; 3, 4, leaves × 20; 5, leaf apex × 200; 6, base of perichaetial leaf showing border on vaginant lamina × 200; 7, upper margin of leaf × 400 (the sharply crenulate margin due to projecting papillae is not correctly shown); 8, capsules × 13; 9, cross section of leaf × 200.

B. *Fissidens obtusifolius kansanus*. 1, leaves × 20; 2, leaf base × 200; 3, margin of vaginant lamina of perichaetial leaf × 200.

C. *Fissidens subbasilaris*. 1, leaves × 20; 2, leaf apex × 150; 3, cross section of leaf × 200.

D. *Fissidens tortilis*. 1, plant × 3; 2, leaves × 20; 3, leaf base × 200; 4, leaf apex × 200; 5, capsules × 20. Drawn from the Pineola, Florida, plants.

E. *Fissidens Kegelianus*. 1, plants × 3; 2, leaves × 20; 3, leaf base × 400; 4, leaf apex × 200; 5, deoperculate capsules; 6, operculate capsule × 20; 7, exothecial cells × 200. (All drawings by Seville Flowers.)

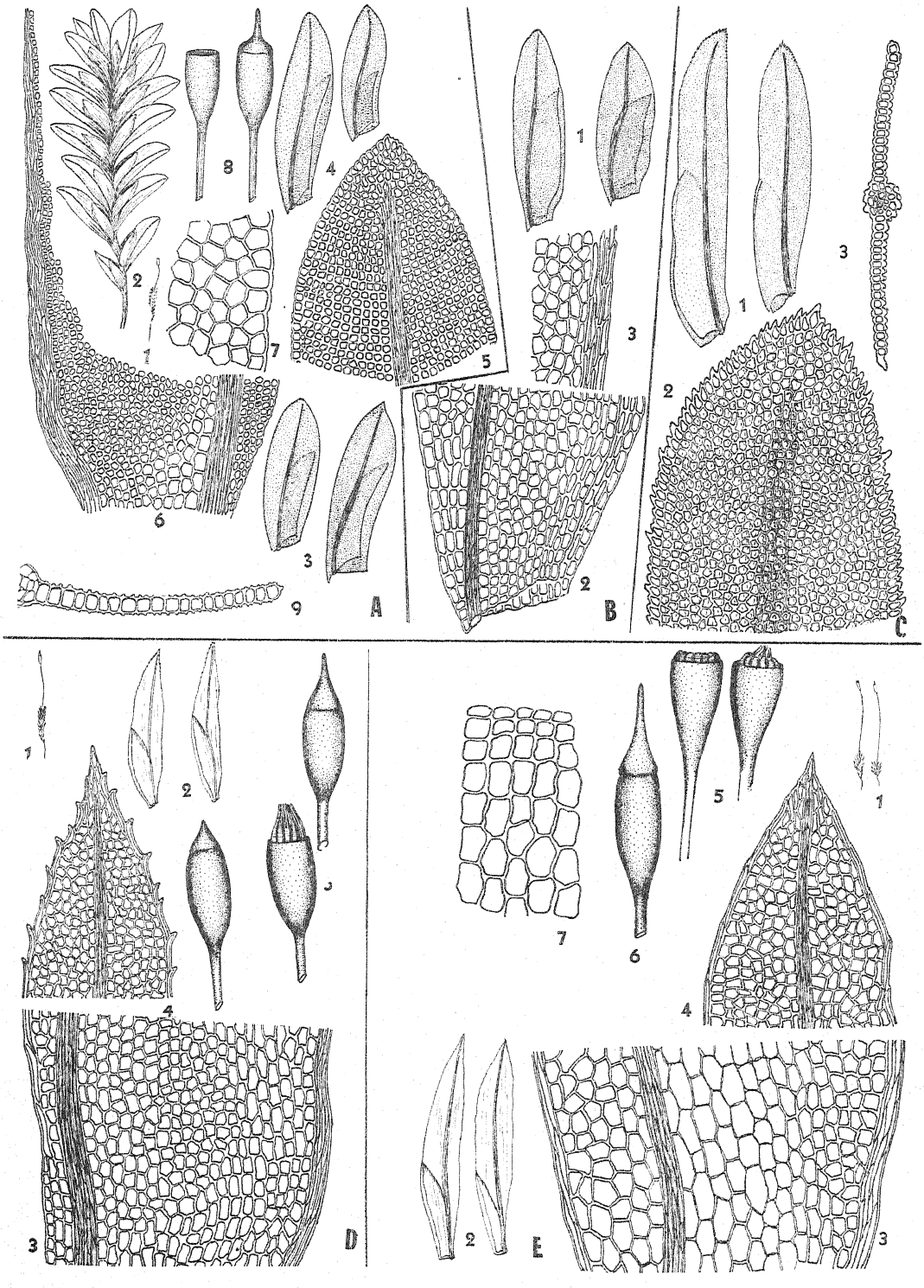


PLATE VII.

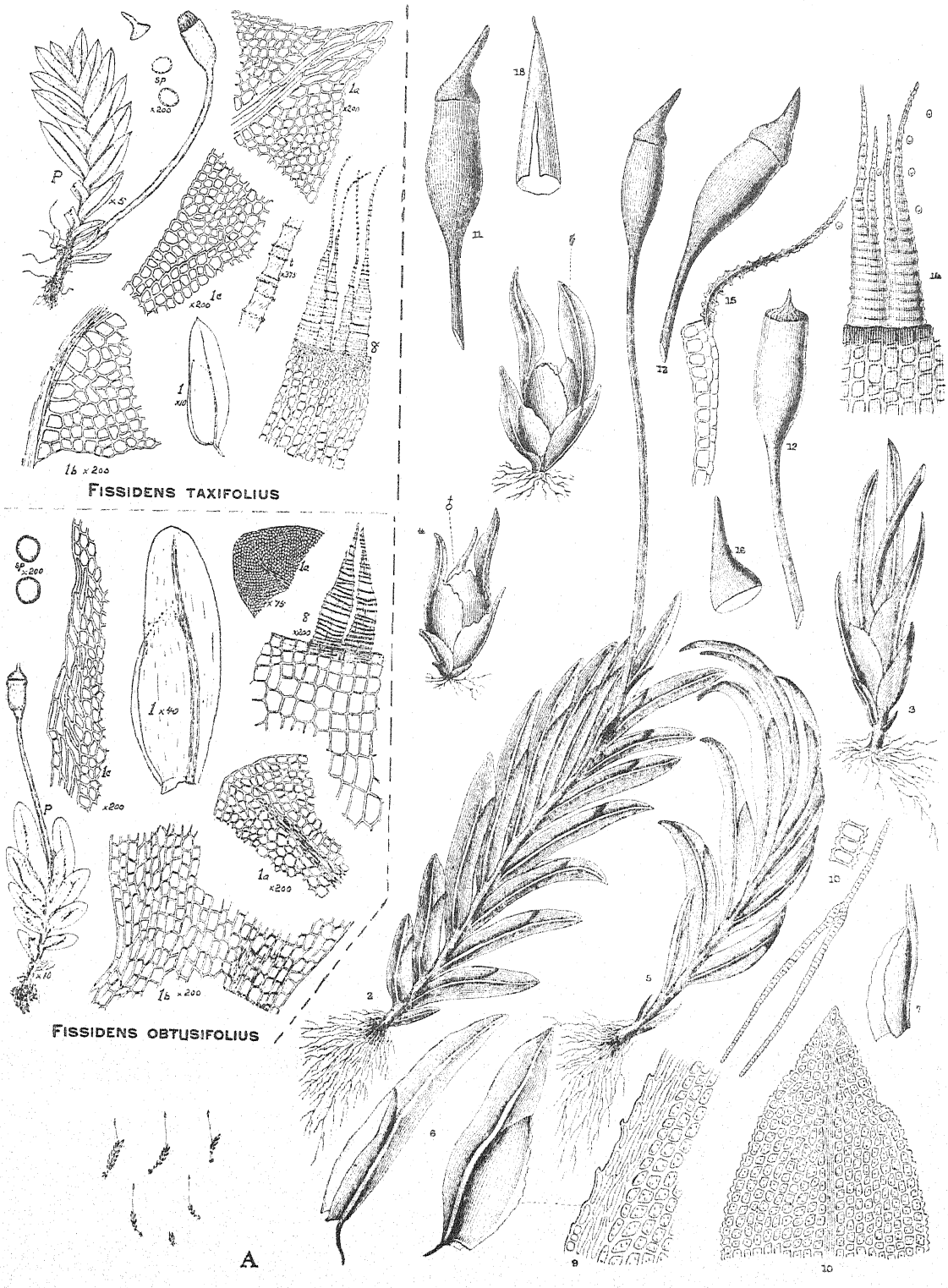


PLATE VIII.

PLATE 8. *Fissidens taxifolius* (from Jennings, Mosses W. Pa. *pl. 11*). *P*, plant enlarged; 1, leaf; 1*a*, cells of leaf apex; 1*c*, cells at apex of vaginant lamina; 1*b*, cells at base of dorsal lamina; 8, exothecial cells and peristome tooth; *t*, portion of tooth; *sp*, spores.

Fissidens obtusifolius (from Jennings, l. c. *pl. 10*). Description as for the preceding.

A. *Fissidens Ravenelii* (from Sull. Icones Musc. *pl. 25*). 1, plants × 1; 2, fruiting plant much magnified; 3, perichaetial leaves; 4, antheridial buds; 5, sterile plant; 6, leaves; 7, perigonial leaf; 9, border of vaginant lamina of perichaetial leaf; 10, leaf apex and cross section of leaf; 11, 12, capsules; 13, deoperculate capsule; 14, 15, peristome teeth; 16, operculum; 18, calyptra.

PLATE 9. *A. Fissidens Closteri* (Sull. Icones Musc. Suppl. *pl. 29*). 2, plant enlarged showing minute calyptra in position; 4, base of plant more enlarged showing antheridial bud; 6, perigonial leaf; 7, base and apex of leaf showing cells; 9, deoperculate capsule with dry peristome; 10, operculum.

B. Fissidens arcticus (from Bryhn, Bryophyta in Itinere Polari Norvagorum Secundo Collecta *pl. 1*).

C. Fissidens pauperculus (from Erythea, **2:** *pl. 1*). *a*, entire fertile plant; *b*, capsules; *ee*, apex of leaf showing cells and portion of leaf above the vaginant laminae; *f*, cells near base of vaginant lamina.

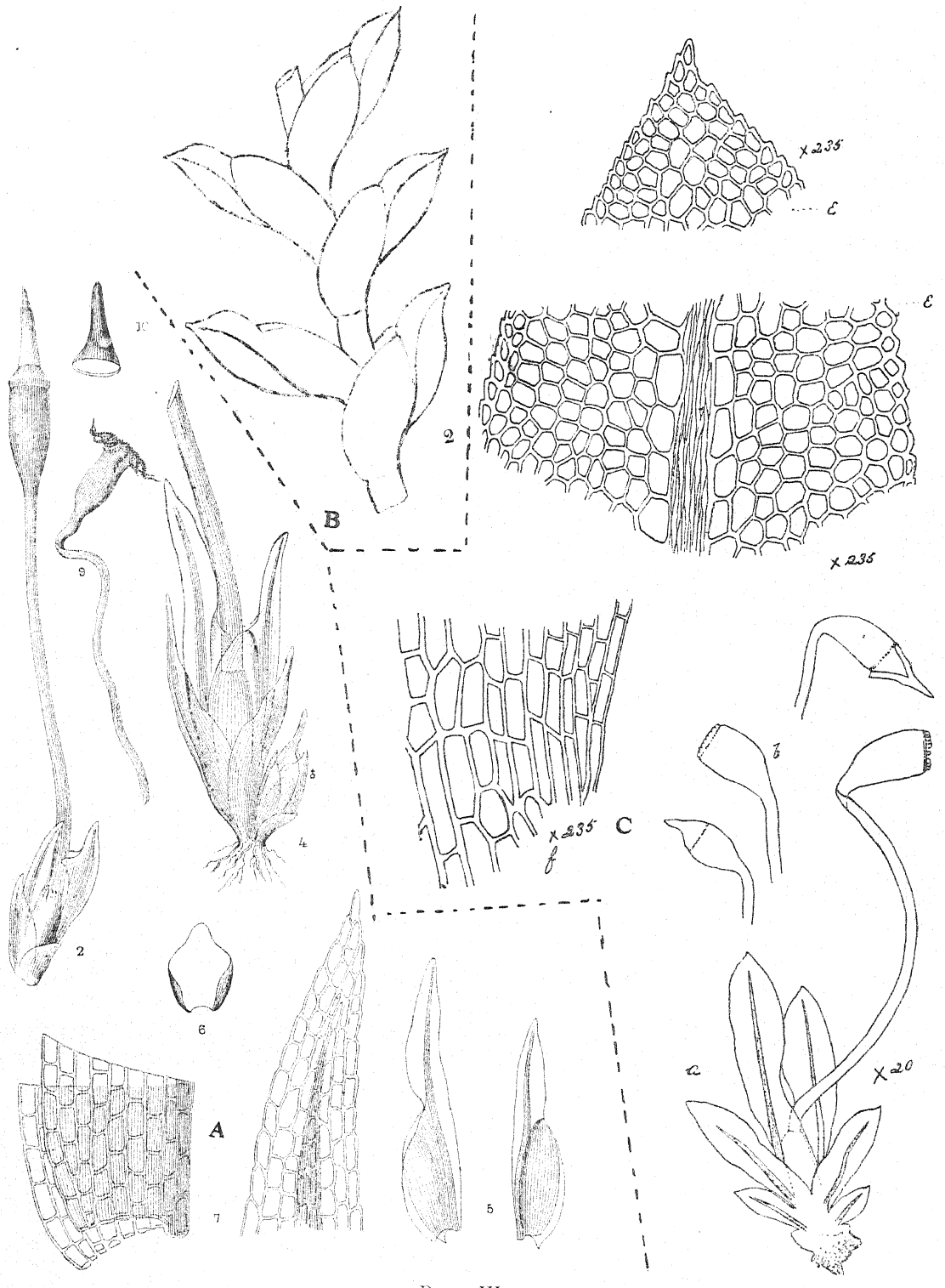
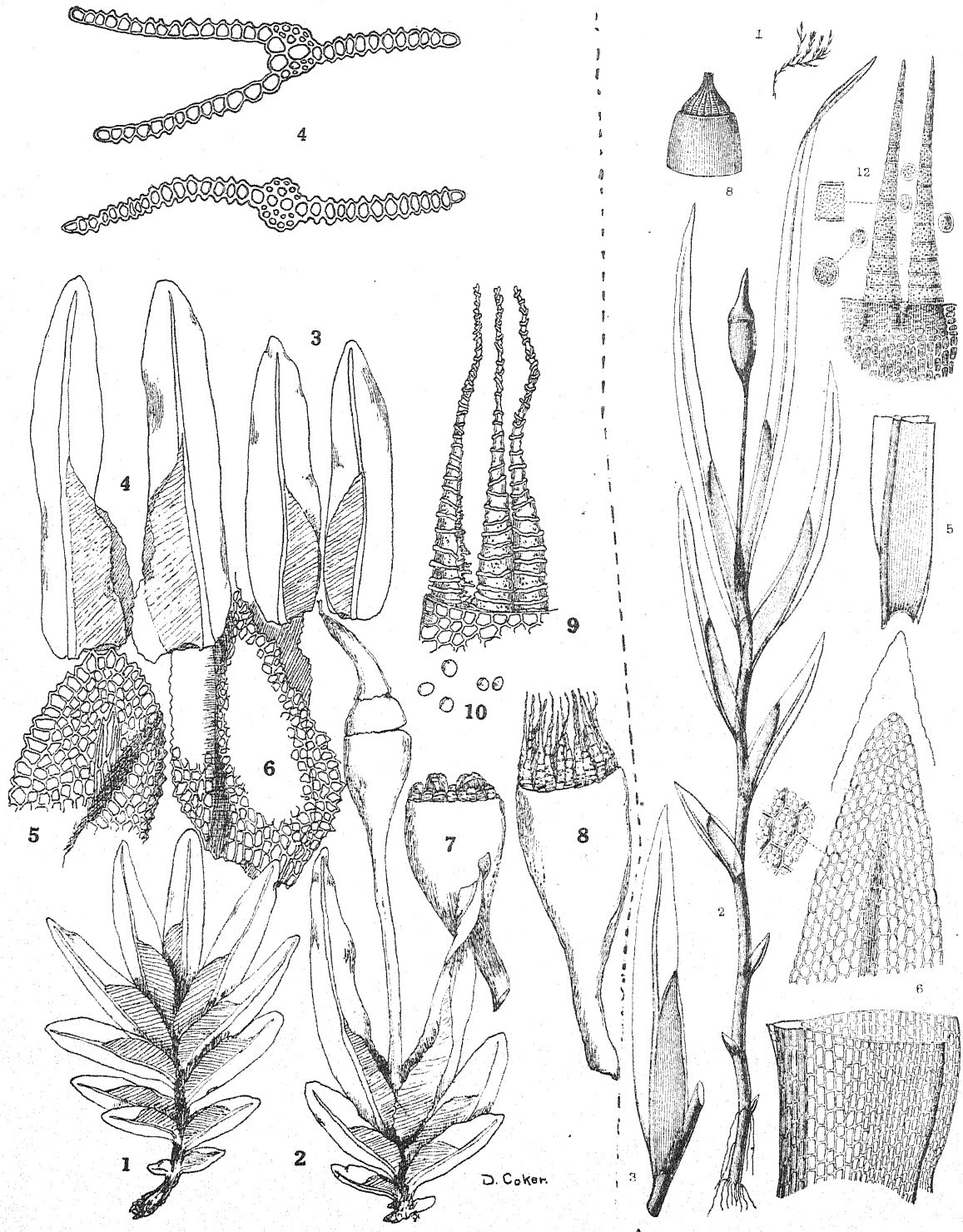


PLATE IX.



Fissidens Donnellii Austin

PLATE X.

PLATE 10. *Fissidens Donnellii* (from Jour. N. Y. Bot. Garden **20:** *pl. 233*). 1, sterile plant; 2, fertile plant showing long perichaetial leaves; 3, leaves showing unequal vaginant laminae; 4, perichaetial leaves; 4′, cross sections of leaf, the lower above the vaginant laminae; 5, apex of leaf showing larger, irregularly serrate marginal cells and profile of dorsal surface with projecting, sharply mamillose cells; 6, base of leaf showing cell structure; 7, capsule with moist incurved peristome; 8, the same with dry erect peristome; 9, peristome teeth showin gmarkings; 10, spores.

A. Fissidens Hallianus (from Sull. Icones Musc. Suppl. *pl. 28*). 1, plants × 1; 2, fruiting plant enlarged; 3, leaf; 5, basal part of leaf; 6, base and apex of leaf showing cell structure; 8, capsule mouth with peristome; 12, peristome teeth and spores, showing insertion of teeth below capsule mouth.

PLATE 11. *A. Fissidens polypodioides* (from Sull. Icones Musc. *pl. 27*). 1, plants ♂ and ♀ × 1; 3, leaf; 7, cells of leaf apex; 8, 9, 10, capsules; 11, peristome teeth and part of annulus; 12, section of peristome; 13, 14, antheridial buds.

B. Fissidens hyalinus (from Sull. l. c. *pl. 21*). 2, 3, plants enlarged; 6, leaf; 8, 9, leaf cells at apex and border; 11, peristome teeth and spores; 13, calyptra; 15, operculum.

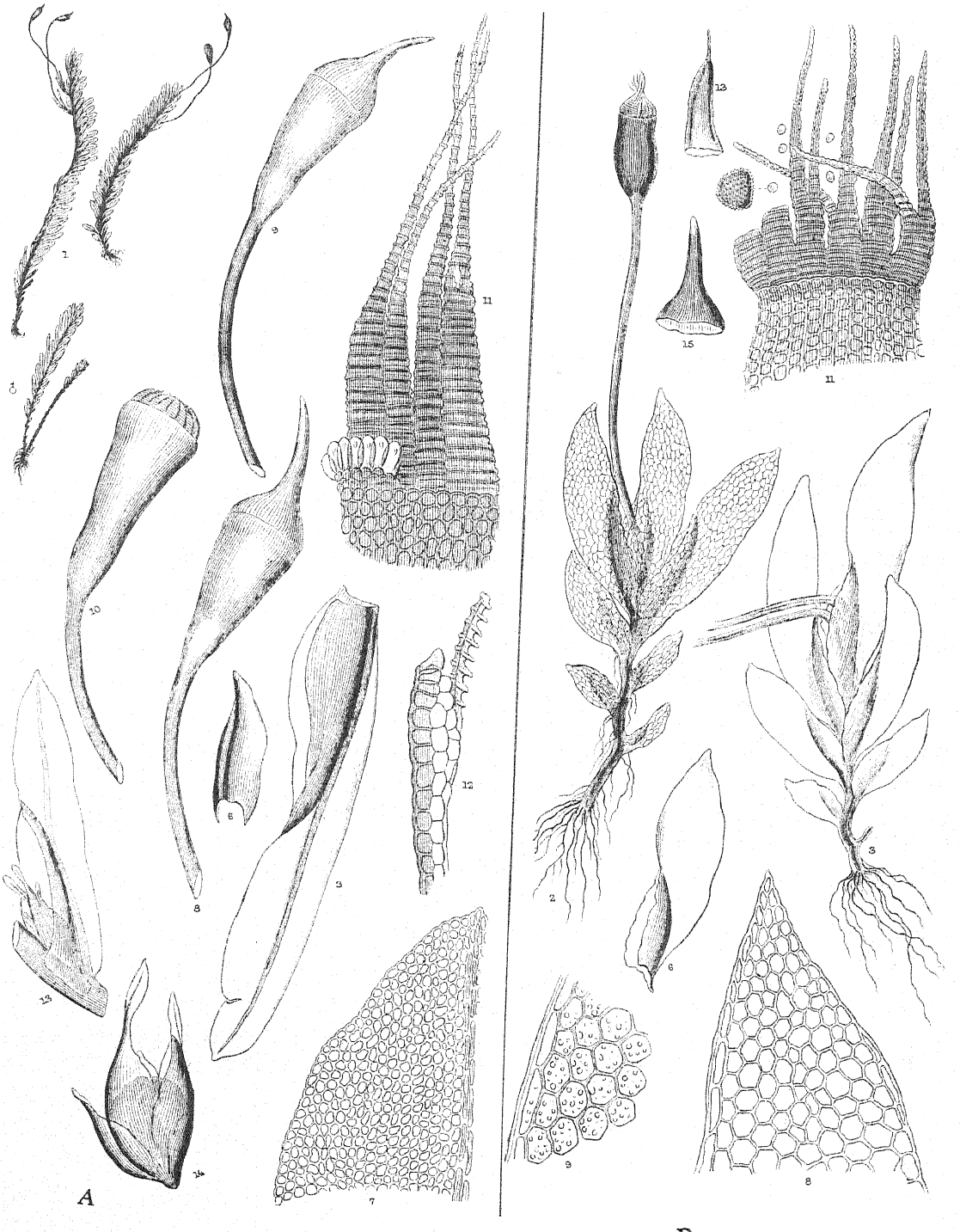


PLATE XI.

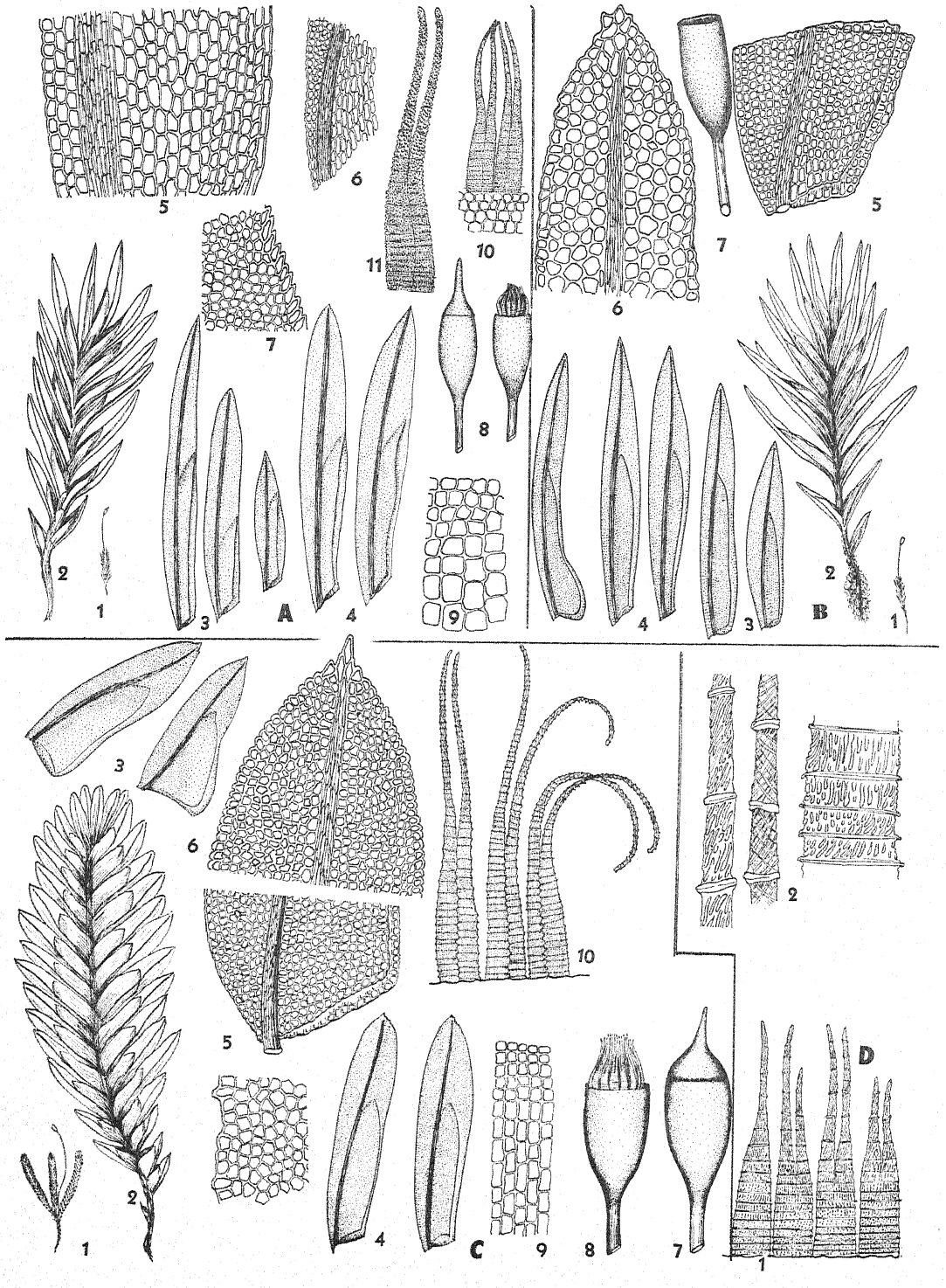


PLATE XII.

PLATE 12. *A. Fissidens Hallii.* 1, plant × 1, 4; 2, plant × 10; 3, leaves × 20; 4, perichaetial leaves × 20; 5, leaf base × 200; 6, leaf base × 100; 7, cells of upper leaf margin × 200; 8, capsules × 13; 9, exothecial cells × 200; 10, peristome teeth × 100; 10, a single tooth × 200.

B. Fissidens subcrenatus. 1, plant × 1.3; 2, plant × 10; 3, leaves × 20; 4, perichaetial leaves × 20; 5, leaf base × 100; 6, leaf apex × 200; 7, capsule × 20.

C. Fissidens Bushii. 1, plant × 1; 2, plant × 5; 4, leaves × 10; 3, perichaetial leaves × 10; 5, leaf base × 200; 6, leaf apex × 200; 7, operculate capsule × 20; 8, deoperculate capsule × 20; 10, peristome.

D. Fissidens manateensis. 1, peristome × 50; 2, portions of teeth × 200 and 400. (All drawings by Seville Flowers.)

PLATE 13. *A. Fissidens sublimbatus.* 1, plant × 3; 2, stem leaves × 20; 3, lower stem leaf × 20; 4, perichaetial leaves; 5, border of vaginant lamina × 200; 6, leaf apex × 200.

B. Fissidens Orcutti. 1, plants × 3; 2, male plants × 3; 3, antheridia and perigonial leaves × 20; 4, stem leaves, upper and lower, × 20; 5, perichaetial leaves × 20; 6, 7, 8, basal, median and apical leaf cells respectively × 200; 9, capsule × 13.

C. 1, leaves of *Pleuridium subulatum* × 20; 2, upper median leaf cells of same × 200; 3, leaves of *P. acuminatum* × 20; 4, upper median leaf cells of same × 200; 5, spores of *Bruchia texana* × 400; 6, spores of *Bruchia Donnellii* × 400; 7, spores of *Bruchia Drummondii* × 400; 8, spore of *Bruchia Carolinae* × 400; 9; peristome of *Distichium Hageni* × 100. (All drawings by Seville Flowers.)

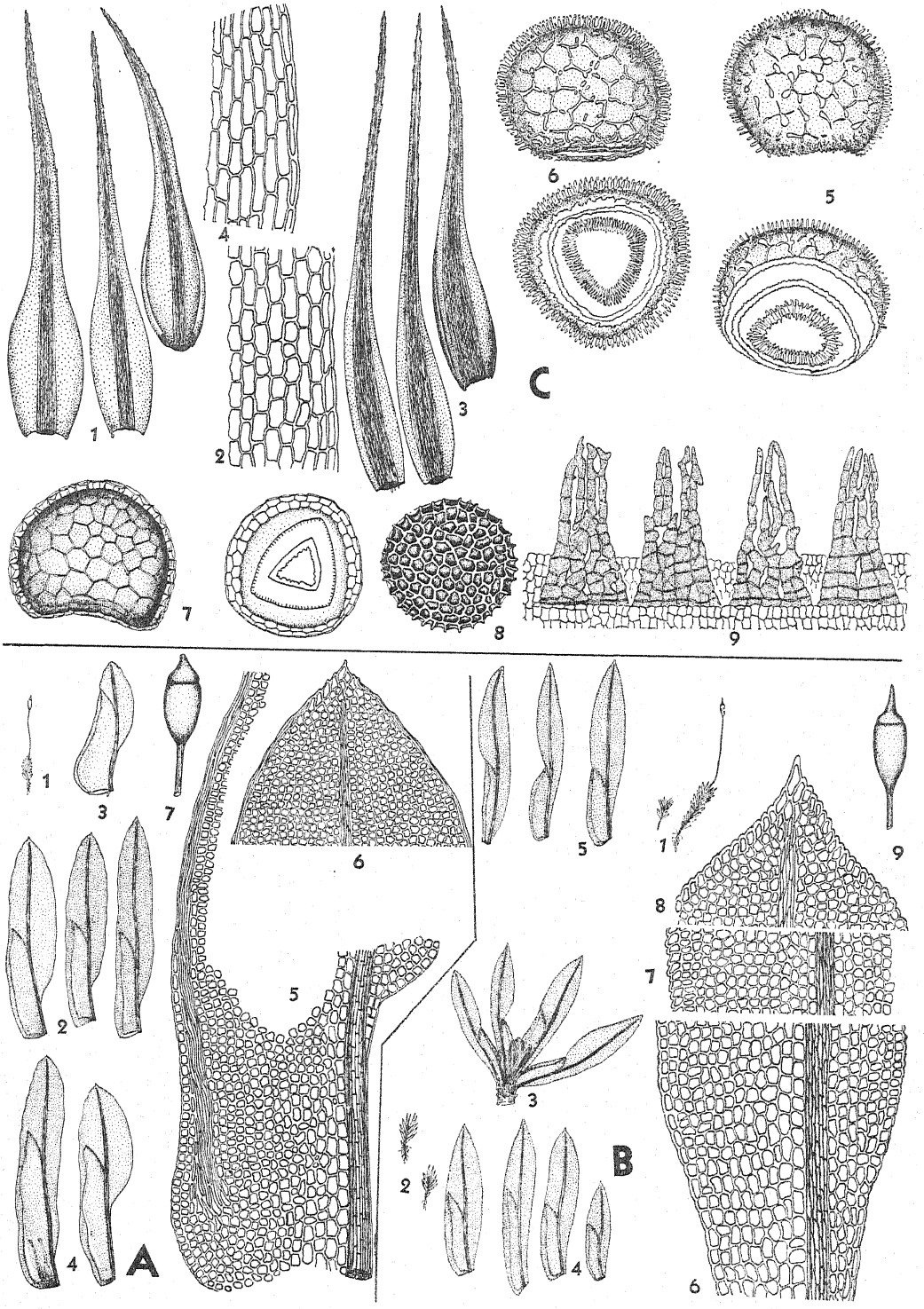


PLATE XIII.

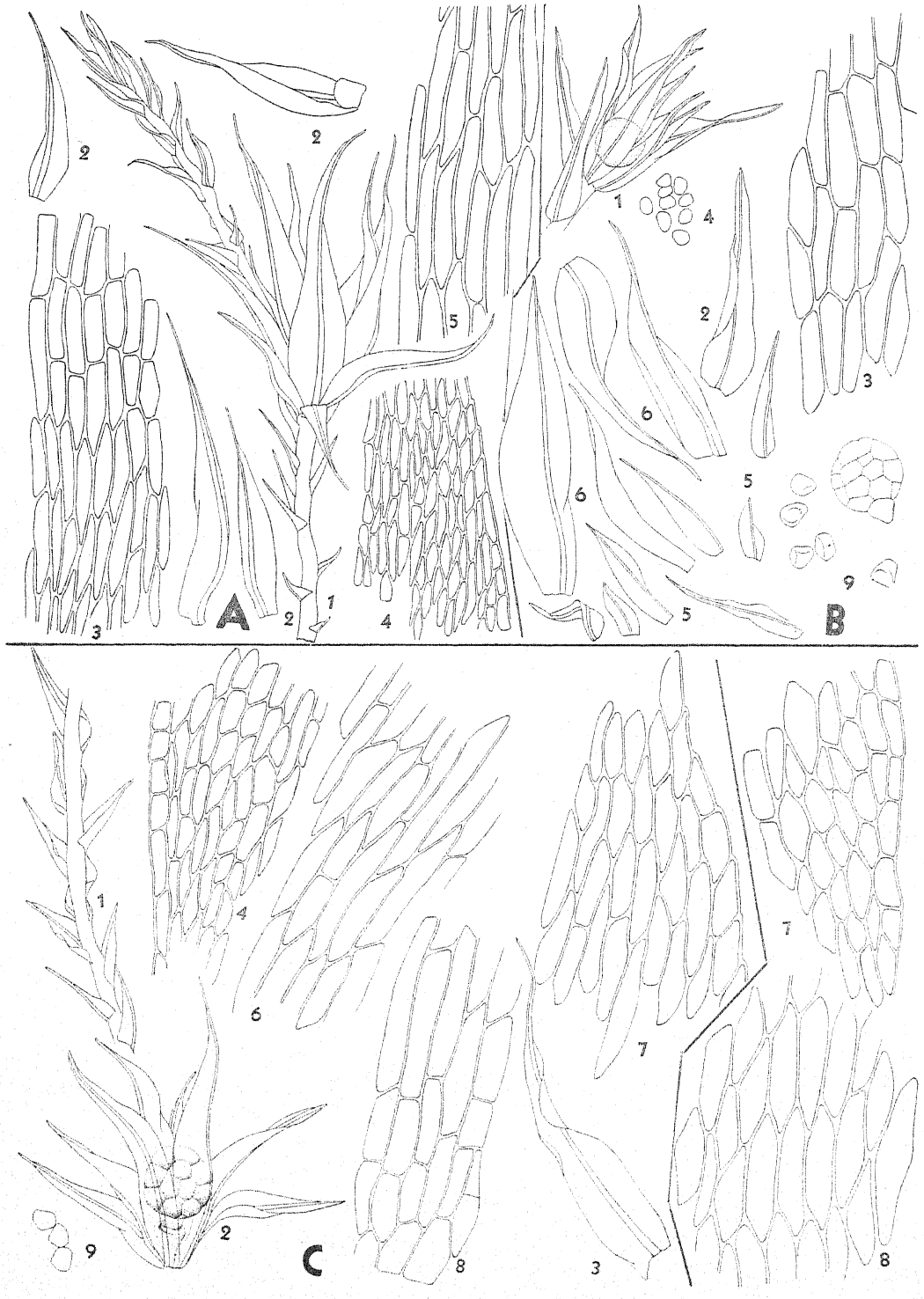


PLATE XIV.

PLATE 14. *A. Archidium Donnellii.* 1, plant × 22; 2, perichaetial leaves × 22; 3, basal cells of perichaetial leaf; 5, median cells of perichaetial leaf; 4, upper cells of stem leaf; all cells × 220.

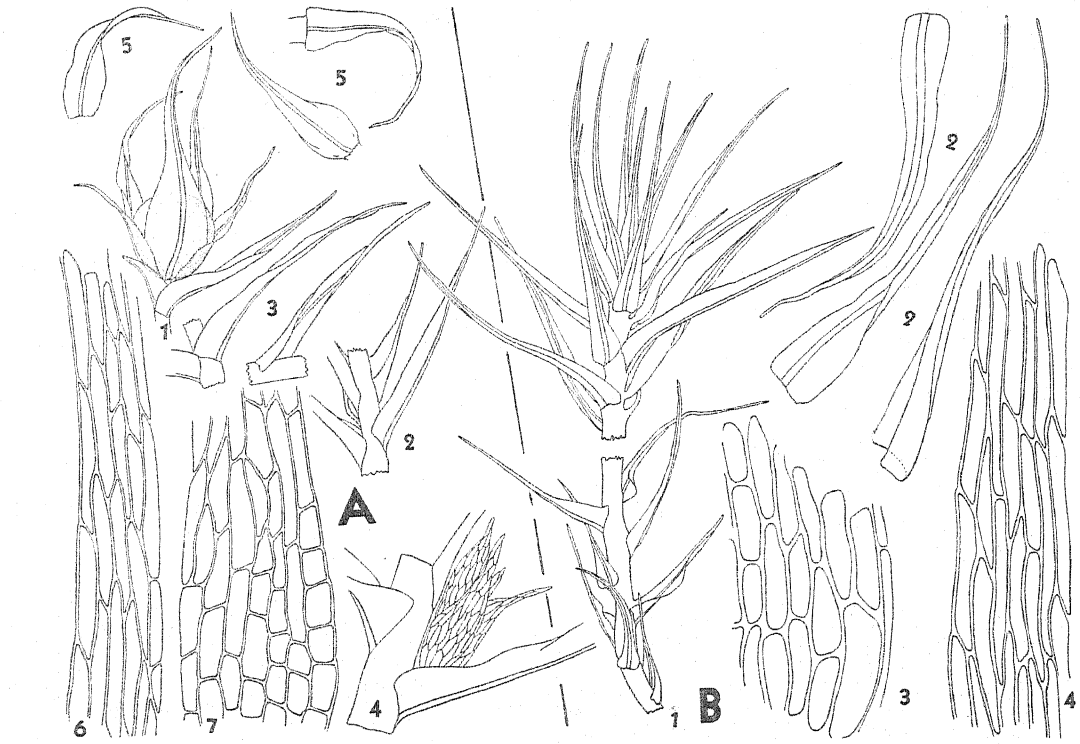
B. 1, *Archidium Hallii* var. *minus* × 22; 2, leaf of same × 22; 3, lower median cells of perichaetial leaf of 1 × 220; 4, spores of 1 × 22; 5, stem leaves of *A. Hallii* × 22; 6, perichaetial leaves of same × 22; 7, median cells of perichaetial leaf near margin × 220; 8, same in interior × 220; 9, capsule and spores × 22.

C. Archidium alternifolium. 1, portion of stem with leaves × 22; 2, perichaetial leaves and capsule × 22; 3, perichaetial leaf × 22; 4, middle marginal cells of stem leaf × 220; 6, median cells of perichaetial leaf × 220; 7, middle marginal cells of same; 8, basal cells of same; 9, spores × 22. (Drawings by Stanley Cain.)

PLATE 15. *A. Archidium floridanum.* 1, perichaetial leaves and capsule × 22; 2, 3, stem leaves × 22; 4, antheridial bud × 53; 5, perichaetial leaves × 22; 6, median marginal cells of stem leaf × 220; 7, basal marginal cells of same × 220 (all from the type).

B. Archidium longifolium. 1, plant × 22; 2, perichaetial leaves × 22; 3, basal marginal cells of perichaetial leaf × 220; 4, median marginal cells × 220. (*A* & *B* drawn by Stanley Cain).

C. Archidium ohioense (from Sull. Icones Musc. *pl. 7*). 1, plants × 1; 2, plants with capsules; 6, leaf showing areolation; 7, capsule with perichaetial leaves; 10, perichaetial leaves; 12, capsule with calyptra; 13, section of capsule with spores; 14, 15, spores; 16, 17, antheridial buds.



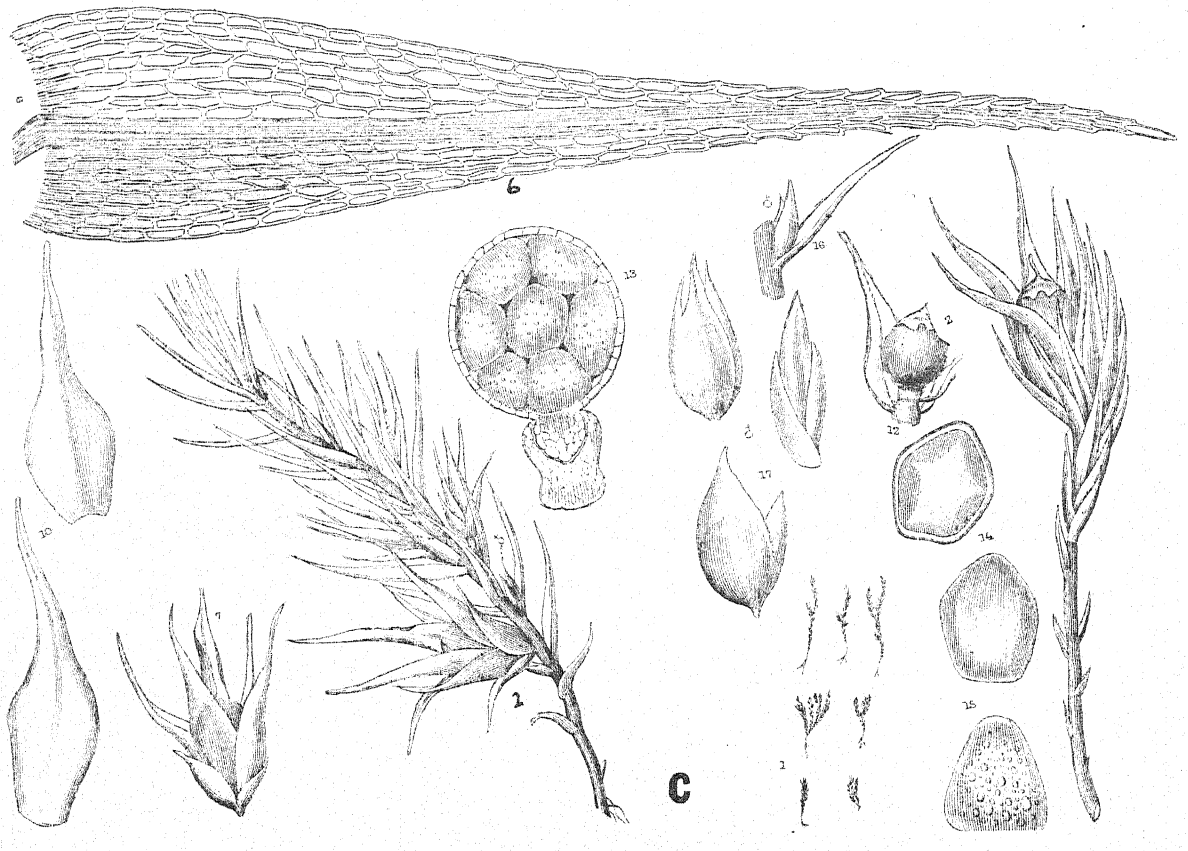


PLATE XV.

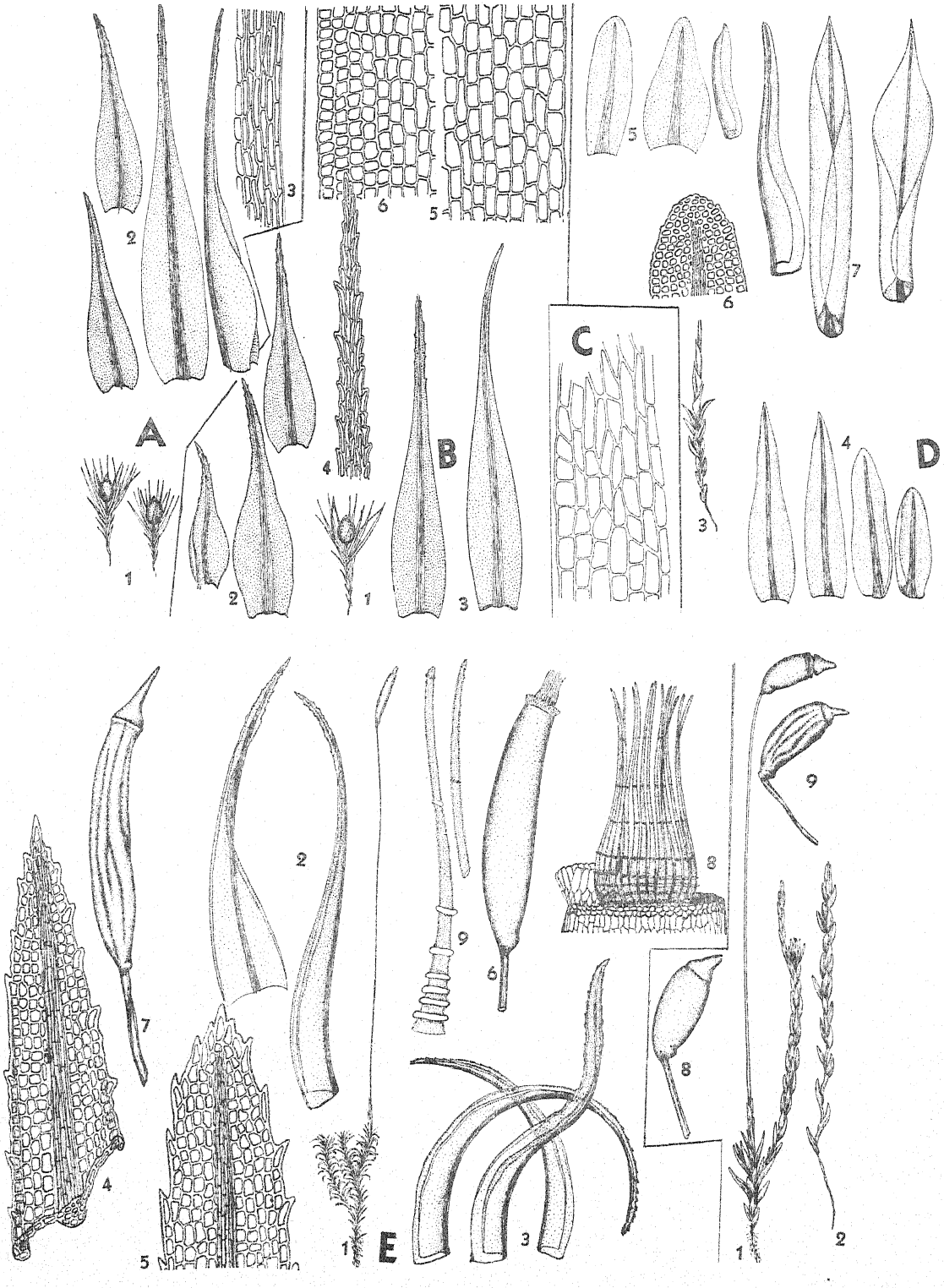


PLATE XVI.

PLATE 16. *A. Pleuridium Ravenelii.* 1, plant × 3; 2, leaves × 20; 3, upper basal leaf cells × 200.

B. Pleuridium californicum. 1, plant × 3; 2, leaves × 20; 3, perichaetial leaves × 20; 4, leaf apex × 200; 5, upper basal leaf cells × 200; 6, upper basal cells of lower leaf × 200.

C. Marginal basal cells of *Archidium ohioense.*

D. Ceratodon heterophyllus. 1, plant with innovation × 7; 2, sterile shoot × 7; 3, fertile stem with young sporophyte; 4, stem leaves × 20; 5, leaves of sterile shoots × 20; 6, apex of upper leaf × 200; 7, comal and perichaetial leaves × 20; 8, 9, capsules moist and dry.

E. Ceratodon stenocarpus. 1, plant × 3; 2, leaves of Mexican plant × 20; 3, leaves of Arizona plant × 20; 4, apex of leaf of Mexican plant × 200; 5, apex of leaf of Arizona plant × 200; 6, moist capsule × 13; 7, same dry; 8, peristome × 100; 9, one prong of peristome tooth × 400. (Drawings, except *C*, by Seville Flowers.)

PLATE 17. *A*. *Pleuridium Sullivanti* (from Sull. Icones. Musc. *pl. 10*). 2, plant much magnified; 4, 5, 6, leaves, stem and perichaetial; 8, 9, 10, leaf cells at base and apex; 11, cross section of leaf.

B. *Pleuridium Bolanderi* (from Bot. Gaz. **37**: *pl. 16*). *2a*, plant × 17; *2b*, leaves × 26; *2b'*, perichaetial leaf × 26; *2c*, leaf apex × 90, and median cells × 270; *2d*, basal leaf cells × 200; *2f*, *2g*, capsules × 26; *2h*, calyptra × 26.

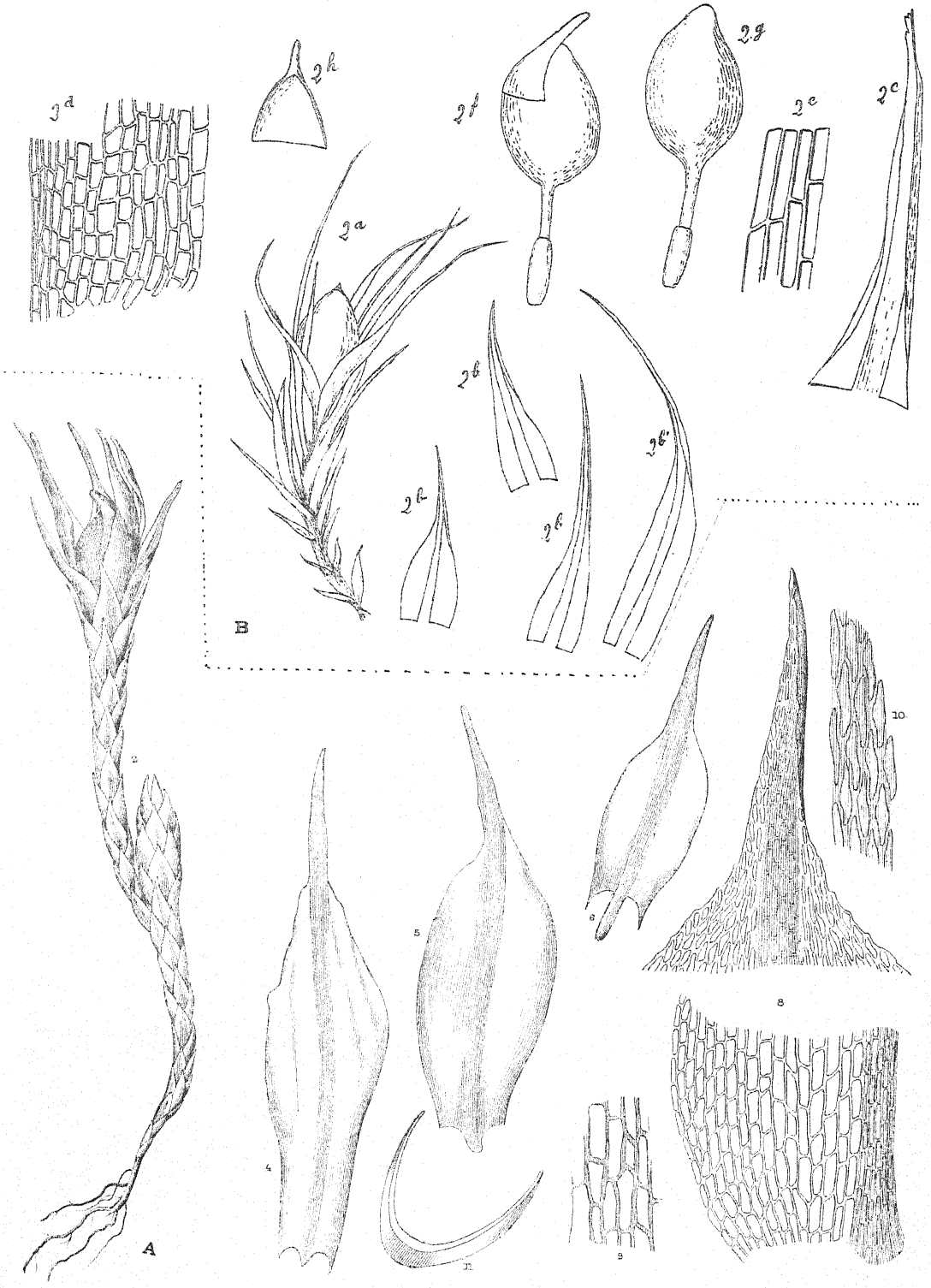
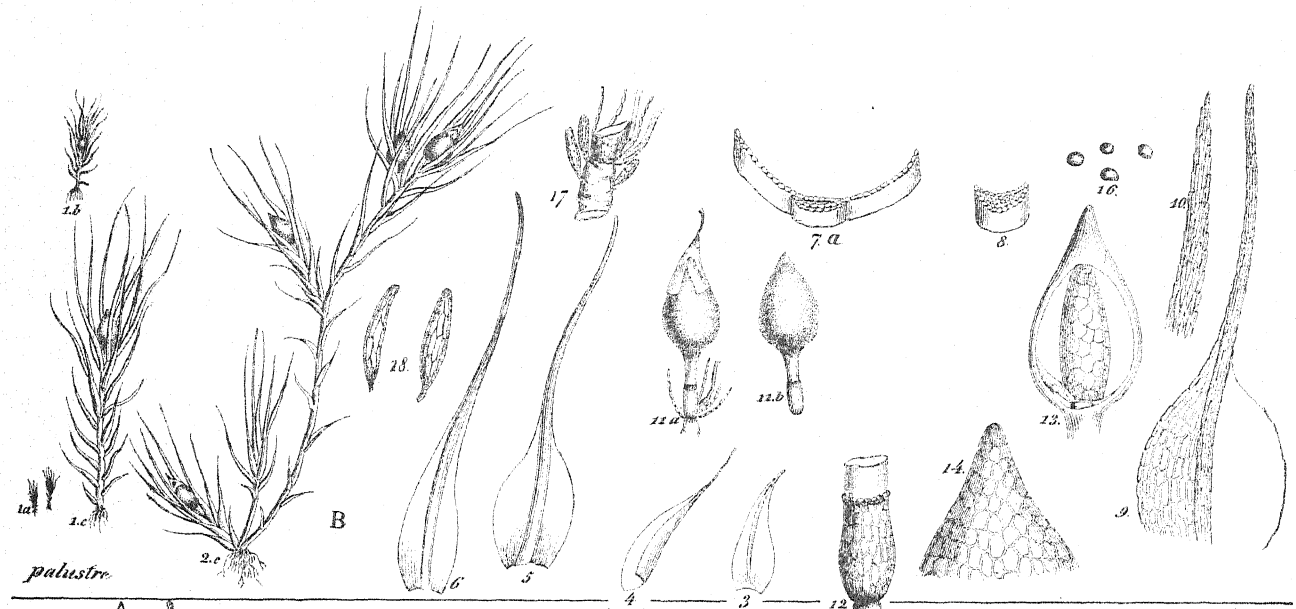
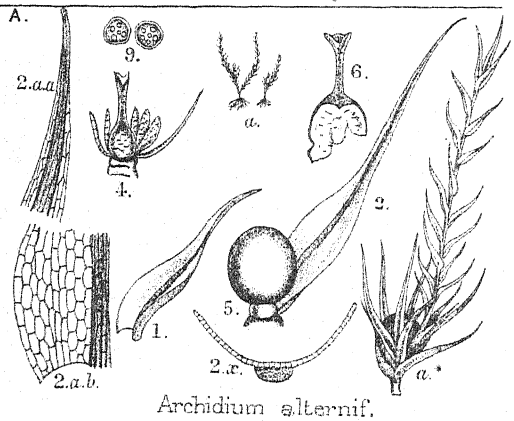
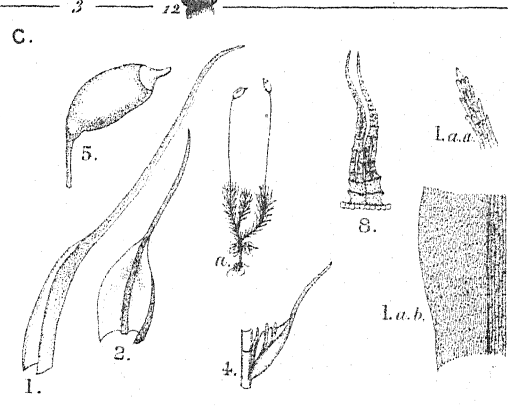


PLATE XVII.

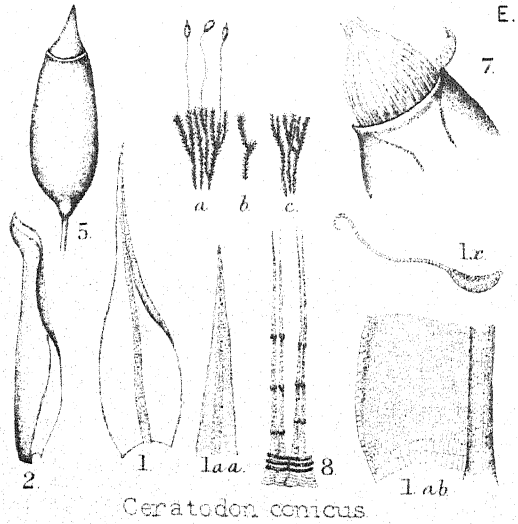




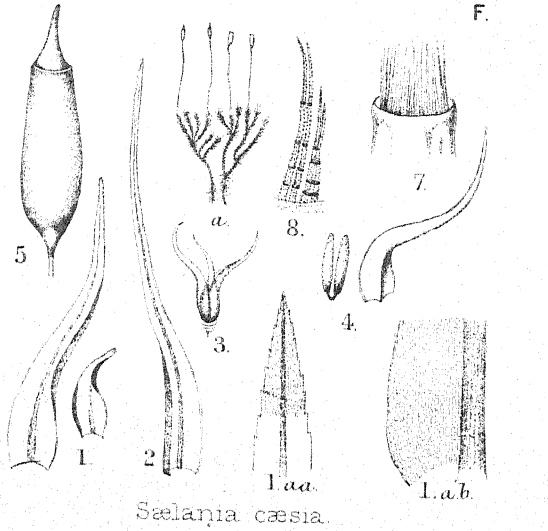
Archidium alternif.



Swartzia inclinata.



Ceratodon conicus



Sælania cæsia.

PLATE XVIII.

PLATE 18. *A. Archidium alternifolium; C. Distichium* (*Swartzia*) *inclinatum; E. Ceratodon conicus; F. Saelania glaucescens* (*caesia*). (*A, C, E, F,* from Braithw. Brit. Moss Fl. 1: plates 14, 15, and 26). *a, b, c,* plants × 1; *a**, same magnified; 1, leaf; 1*a*, apical leaf cells; 1*b*, basal leaf cells; 1*x*, cross section of 1; 2, perichaetial leaf; 2*aa* and 2*ab*, apical and basal cells of 2; 3, 4, antheridial bud and archegonia; 5, capsule; 6, calyptra; 7, 8, peristome.

B. Pleuridium palustre. (From Bry. Eur.). 1*a*, 1*b*, plants × 1; 1*c*, 2*c*, plants enlarged; 3, 4, 5, 6, leaves; 7*a*, 8, cross sections of leaf; 9, leaf cells; 10, leaf apex, 11*a*, 11*b*, capsules; 12, vaginula; 13, 14, capsule structure.

PLATE 19. *A. Bruchia flexuosa* (from Sull. Icones Musc. Suppl. *pl. 15*). 2, plant enlarged; 4, stem leaves; 5, leaf showing cells; 6, perichaetial leaf; 8, longitudinal section of capsule; 9, calyptrae.

B. Bruchia Sullivantii (from Sull. Icones Musc. *pl. 13*). 3, 4, plants enlarged; 5, 6, leaves; 7, 8, cells of leaf base and apex respectively; 9, cross section of leaf; 11, calyptra; 12, spores.

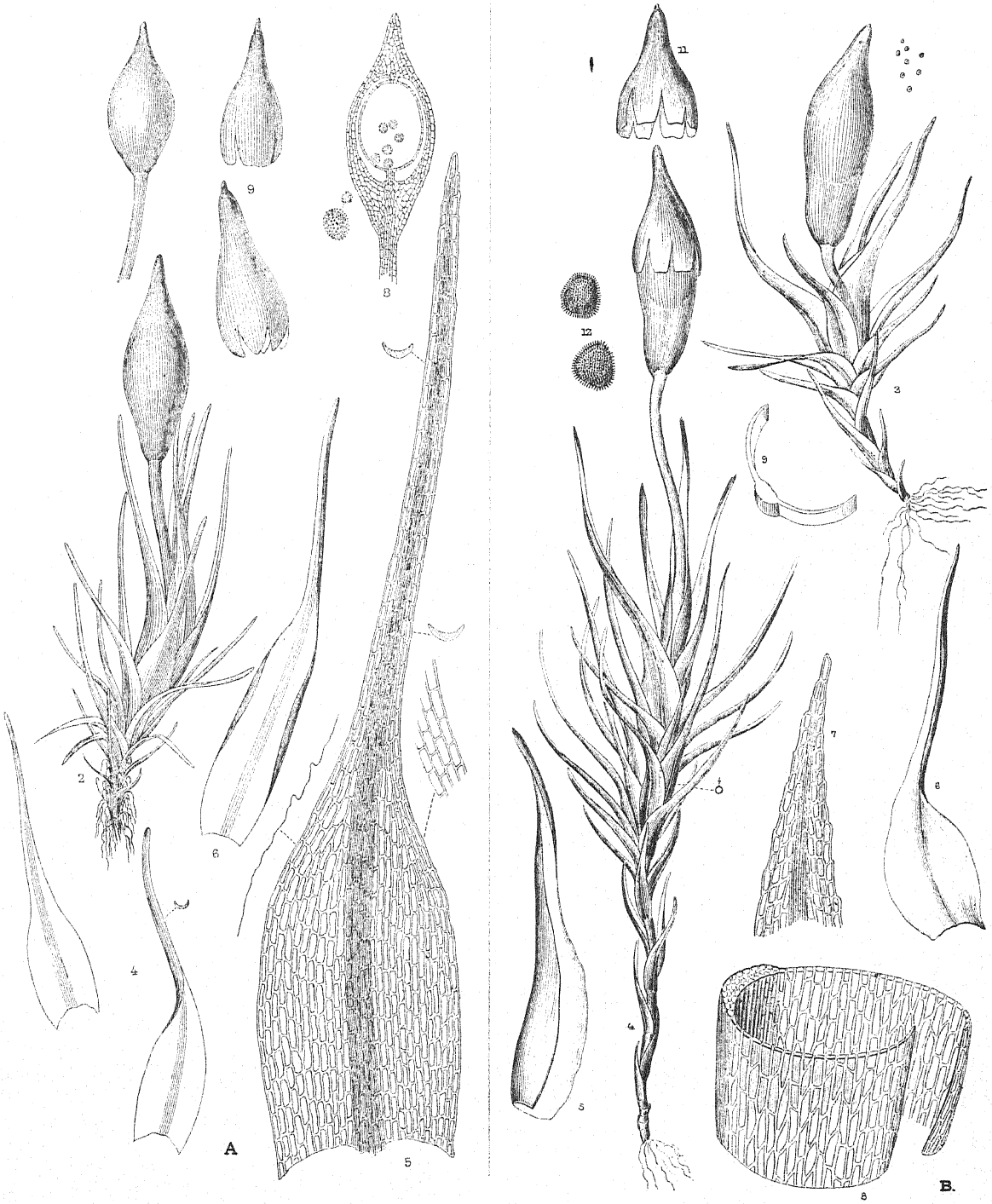
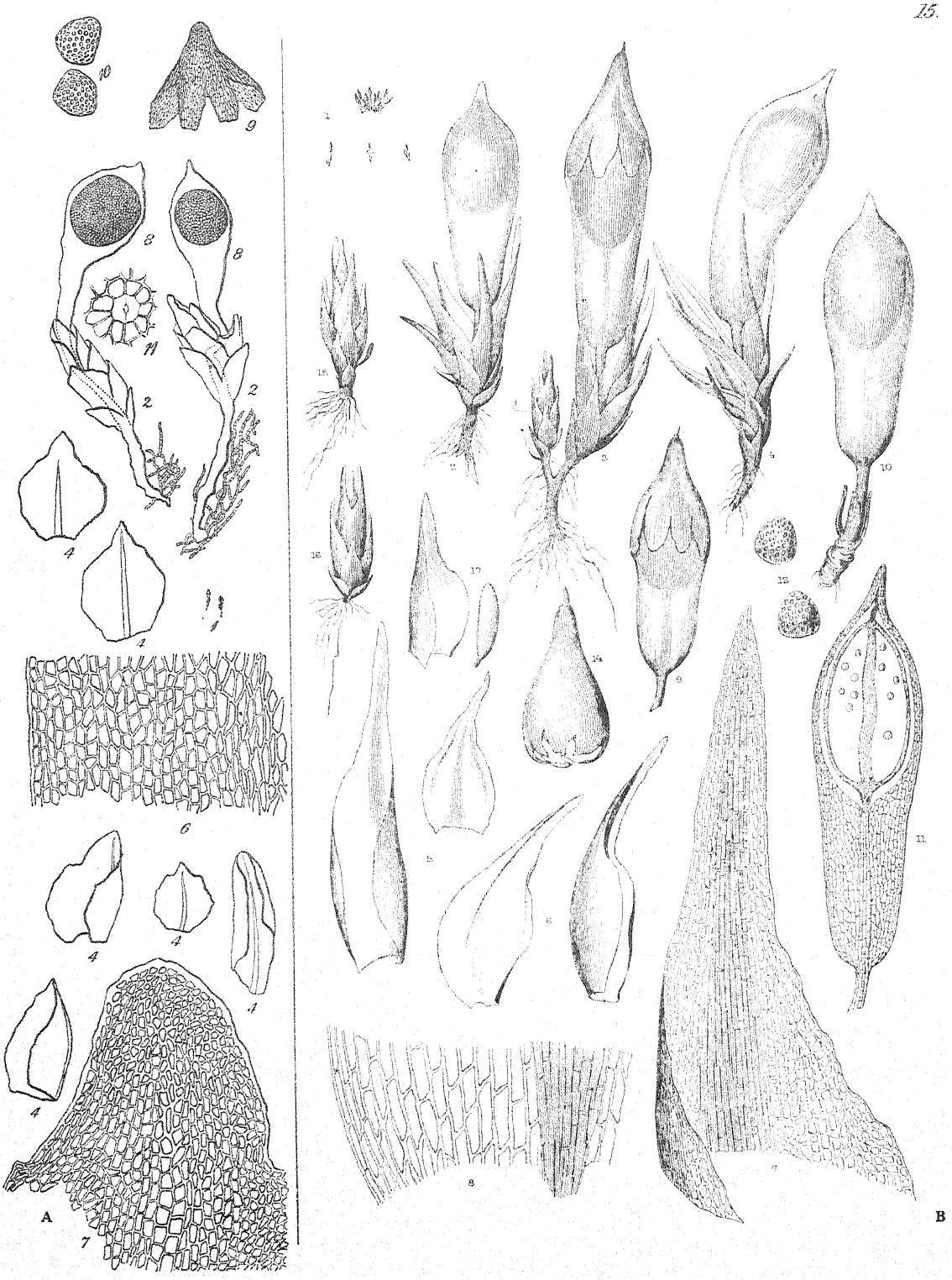


PLATE XIX.



ERUCHIA BREVIFOLIA, Sulliv.

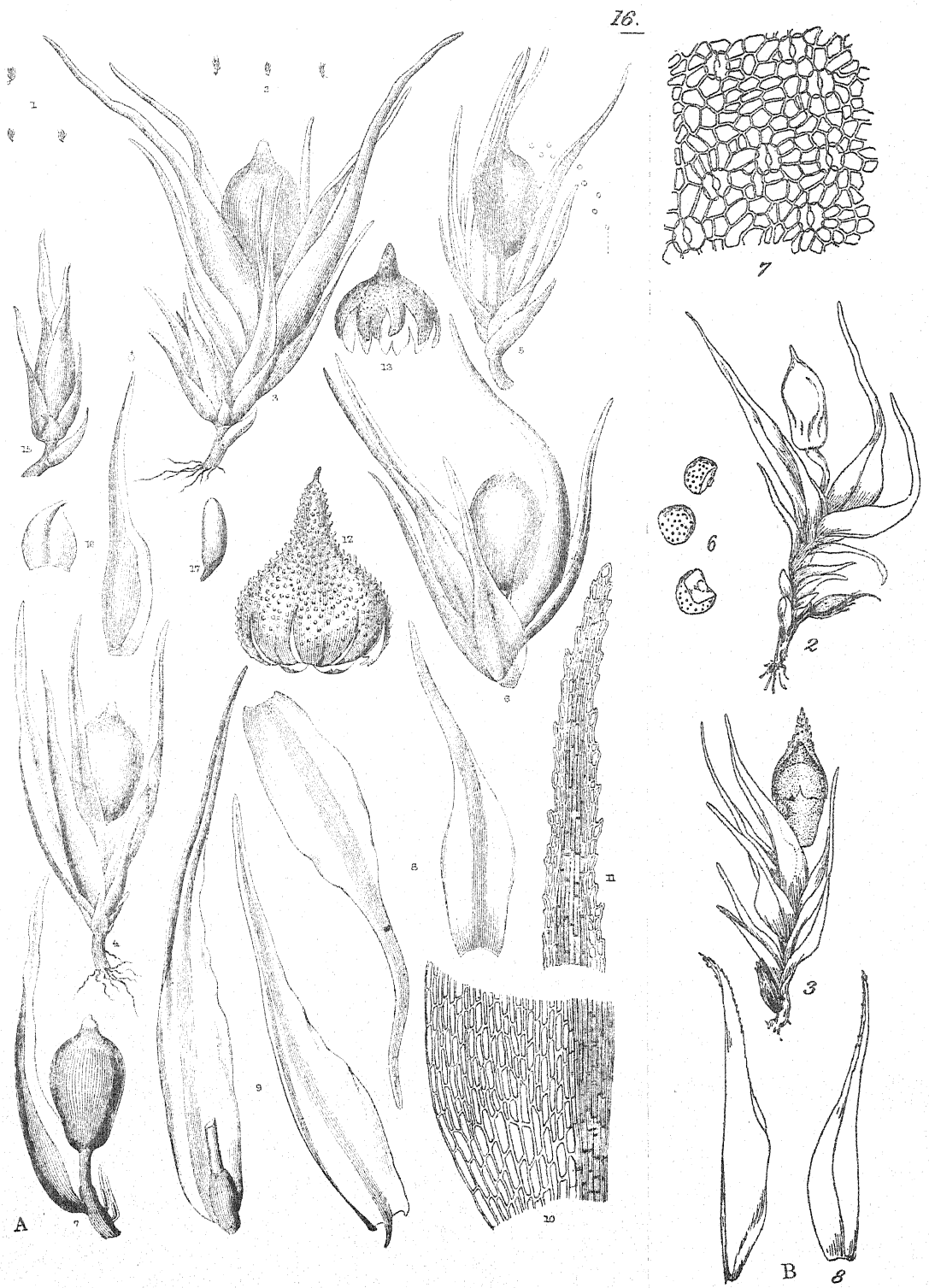
PLATE XX.

PLATE 20. *A*. *Bruchia fusca* (from Bull. Torr. Club **21**: *pl. 216*). 1, plants × 1; 2, enlarged; 4, leaves; 6, median leaf cells; 7, leaf apex showing cells and vanishing costa; 9, calyptra; 10, spores; 11, stoma.

B. *Bruchia brevifolia* (from Sull. Icones Musc. *pl. 15*). 1, plants × 1; 2, 3, 4, plants enlarged; 5, 6, leaves; 7, 8, cells at apex and base of leaf respectively; 9, 10, capsules; 11, longitudinal section of capsule; 12, spores; 13, calyptra; 15, 16, 17, male inflorescence and antheridia.

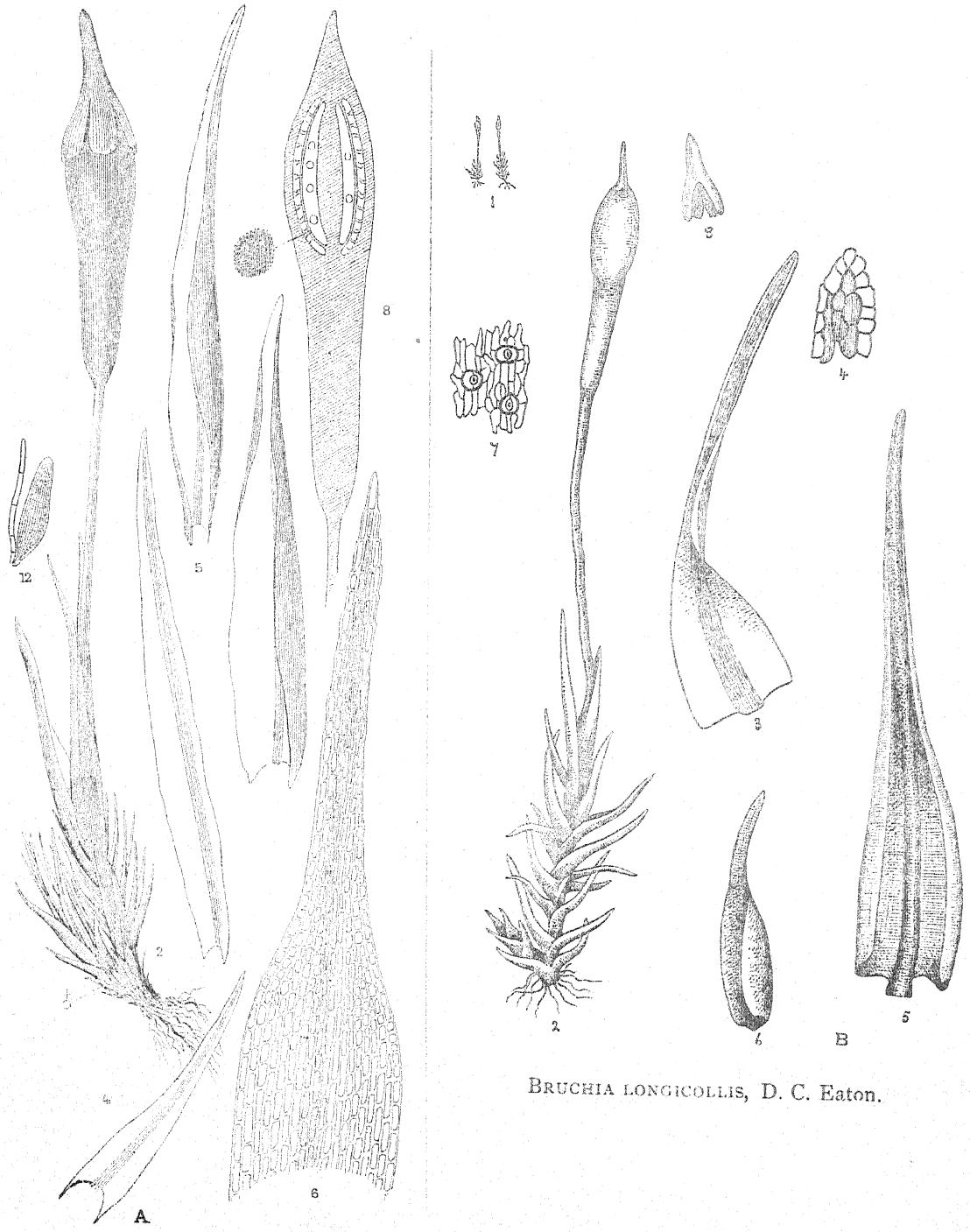
PLATE 21. *A. Bruchia Ravenelii* (from Sull. Icones Musc. *pl. 16*). 1, 2, plants × 1; 3, 4, 5, 6, plants enlarged; 7, capsule with perichaetial leaf; 8, upper stem leaves; 9, perichaetial leaves; 10, 11, cells of leaf base and apex respectively; 12, 13, calyptrae; 15, antheridial bud; 16, 17, perigonial leaves and antheridium.

B. Bruchia Carolinae (from Bull. Torr. Club **21**: *pl. 217*). 2, 3, plants enlarged; 6, spores; 7, exothecial cells and stomata; 8, leaves.



BRUCHIA RAVENELII, Wils.

PLATE XXI.



BRUCHIA LONGICOLLIS, D. C. Eaton.

PLATE XXII.

PLATE 22. *A. Bruchia Bolanderi* (from Sull. Icones Musc. Suppl. *pl. 14*). 2, plant enlarged; 4, 5, leaves; 6, leaf showing cells; 8, longitudinal section of capsule; 12, antheridium.

B. Bruchia longicollis (from Bull. Torr. Club **17**: *pl. 101*). 1, plants × 1; 2, plant enlarged; 3, leaf; 4, apex of 3; 5, perichaetial leaf; 6, perigonial leaf; 7, stomata of neck; 8, calyptra.

PLATE 23. *A*. *Bruchia texana* (from Bull. Torr. Club **21**: *pl. 213*). 1, plants × 1; 2, plant enlarged; 3, leaves; 4, 5, cells of leaf base and apex respectively; 7, dry capsule; 8, calyptra.

B. *Bruchia Donnellii* (from Bull. Torr. Club **21**: *pl. 214*). 1, plants × 1; 2, 3, plants enlarged; 6, calyptra; 8, leaves; 9, 10, cells of leaf base and apex respectively.

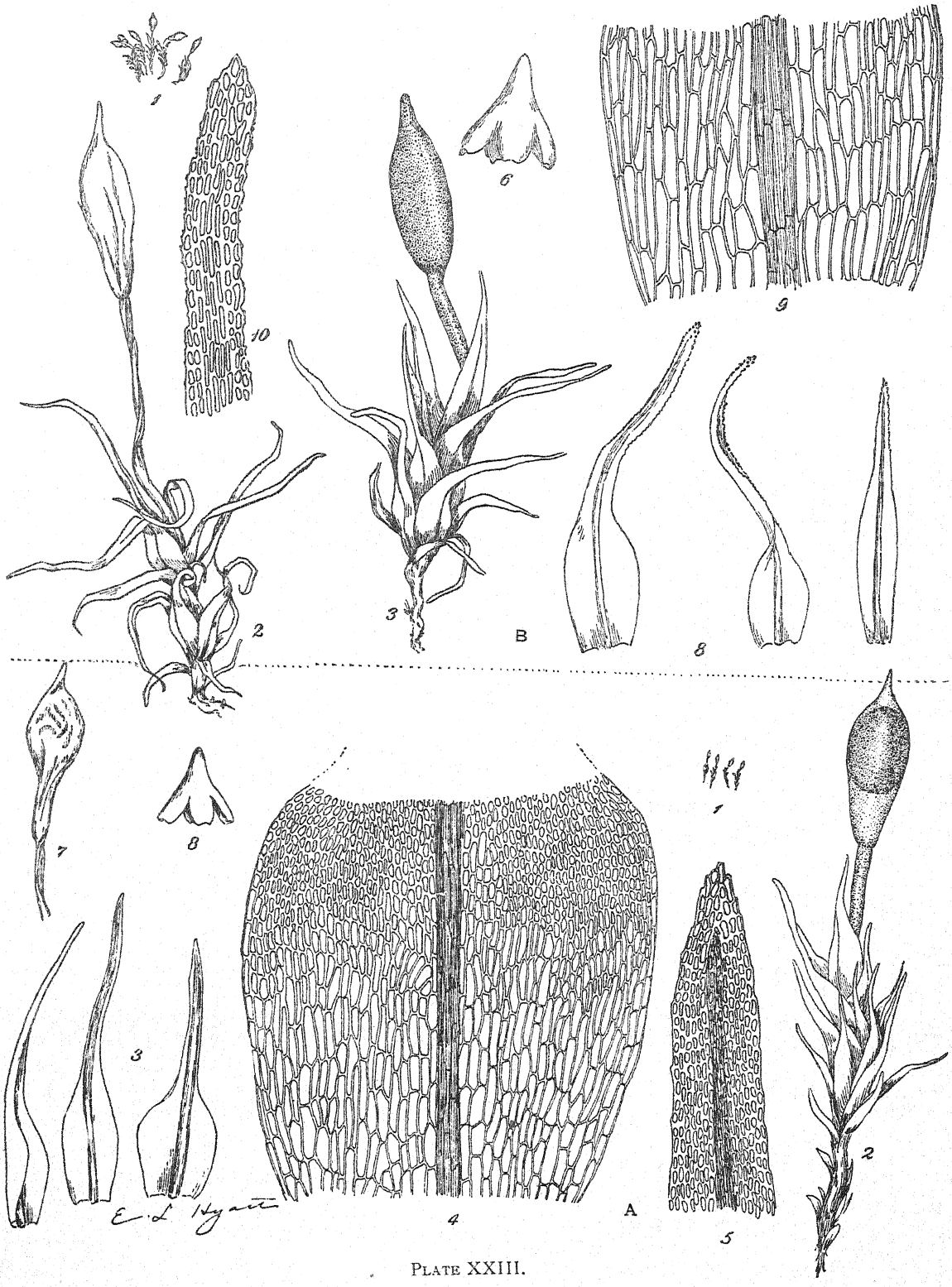
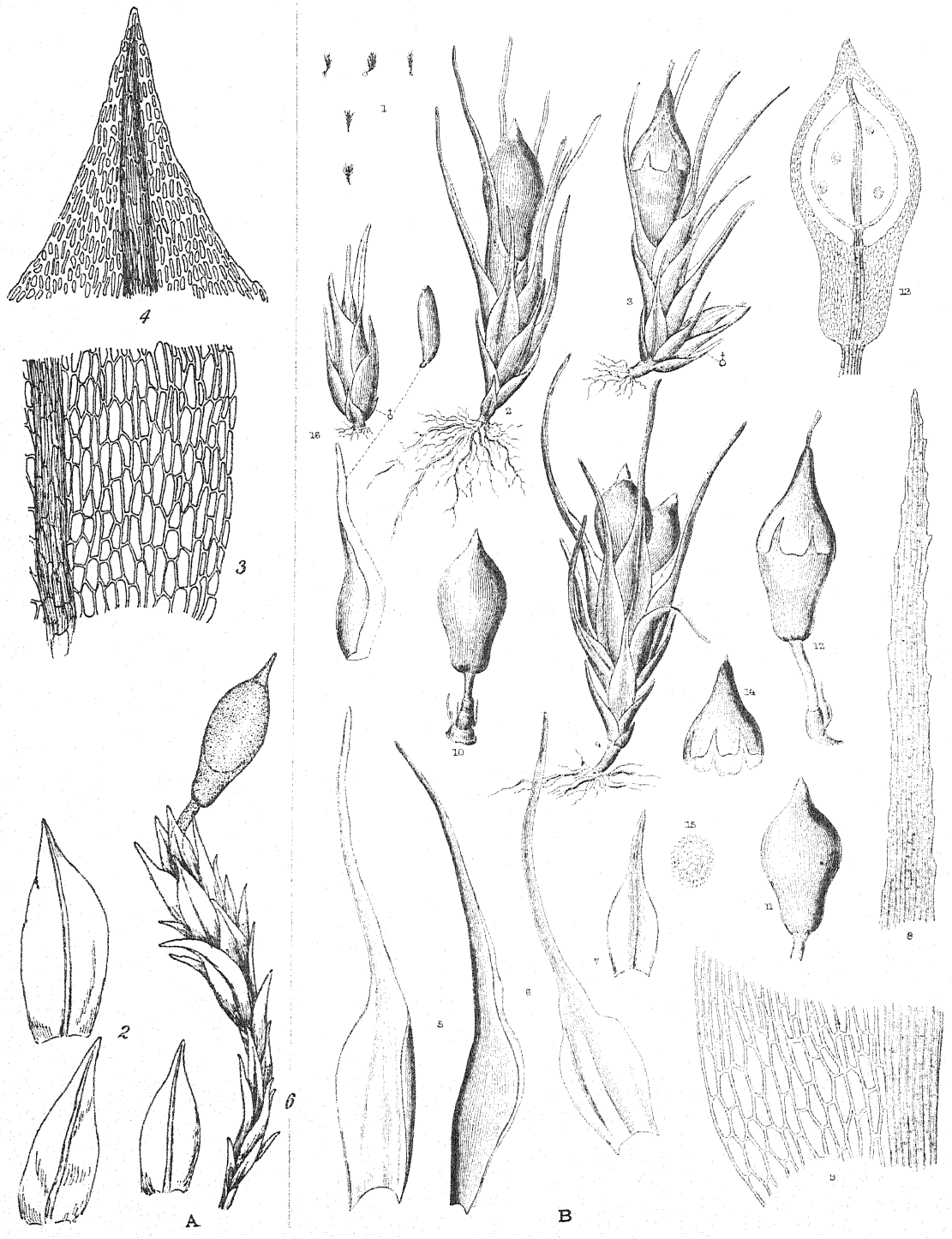


PLATE XXIII.



BRUCHIA BREVIPES, Hook.

PLATE XXIV.

PLATE 24. *A*. *Bruchia Hallii* (from Bull. Torr. Club. **21**: *pl. 215*). 2, leaves; 3, 4, cells of leaf base and apex respectively; 6, plant much enlarged.

B. *Bruchia Drummondii* (from Sull. Icones Musc. *pl. 14*) (as *B. brevipes*). 1, plants × 1; 2, 3, 4, plants magnified; 5, 6, 7, leaves; 8, 9, cells of leaf apex and base respectively; 10, 11, 12, capsules; 13, longitudinal section of capsule; 14, calyptra; 16, antheridial bud with leaf and antheridium. (15 does not accurately represent the spore, see *pl. 21*).

PLATE 25. *Trematodon longicollis.* (Sull. Icones Musc. *pl. 19*). 1, plants × 1; 2, part of a plant enlarged; 3, 4, stem leaves; 5, leaf apices showing cell structure; 6, leaf cells at base; 7, cross sections of leaf; 8, perichaetial leaf, vaginula and base of seta; 9, capsules; 10, dry capsule; 11, mouth of capsule with peristome; 12, calyptra; 13, operculum; 14, 15, peristome teeth and annulus; 16, annulus; 17, antheridia and perigonial leaf.

TREMATODON LONGICOLLIS, Michx.

PLATE XXV.

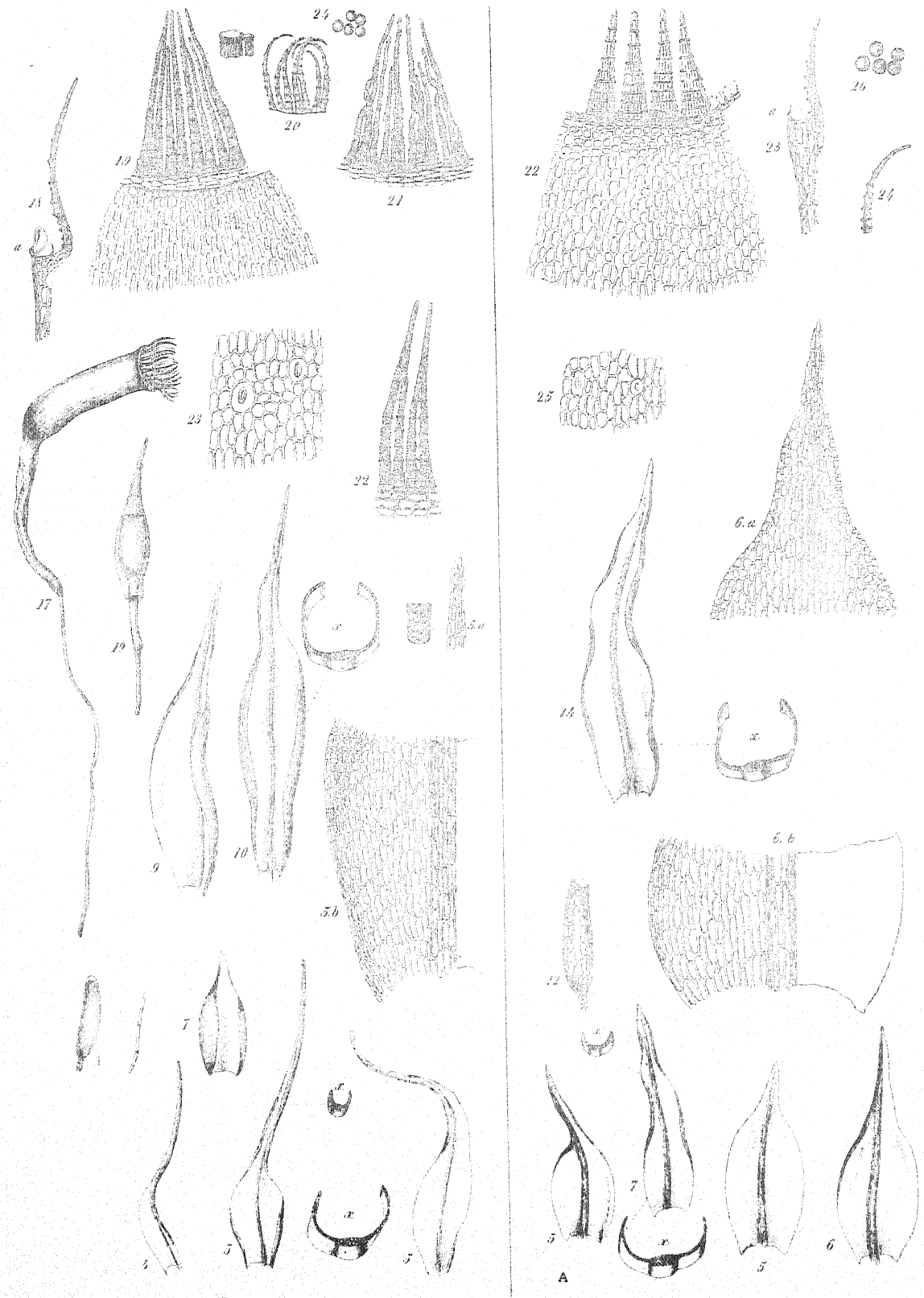


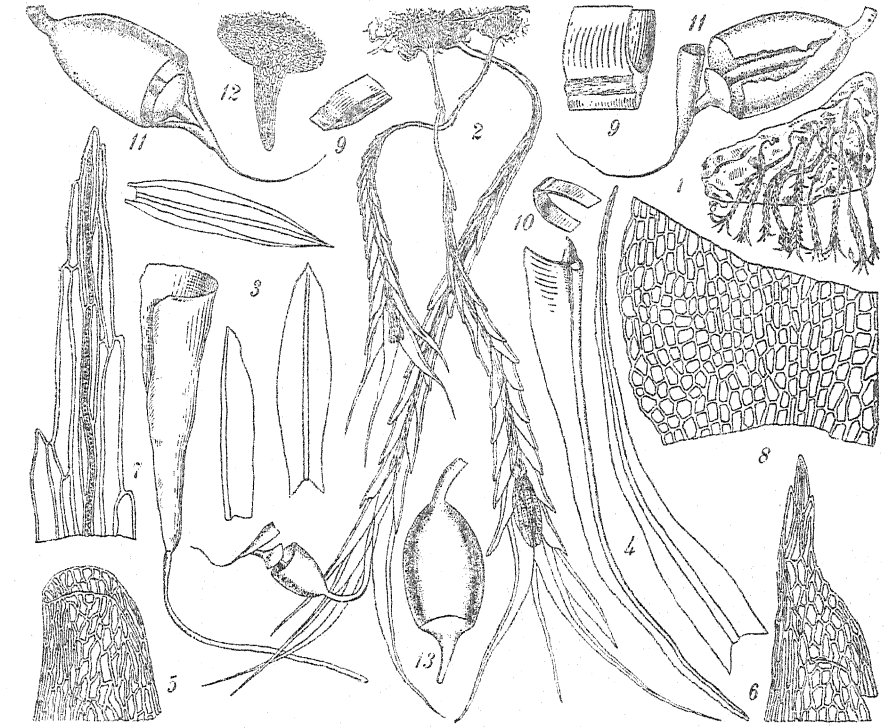
PLATE XXVI.

PLATE 26. *A*. *Trematodon brevicollis* (from Bry. Eur. *pl. 95*). 5–7, leaves; 6*a*, 6*b*, cells of leaf apex and base respectively; 14, perichaetial leaf; 12, antheridium; 22, mouth of capsule with four peristome teeth; 23, longitudinal section of same showing annulus; 24, side view of tooth; 25, exothecial cells and stomata; 26, spores.

B. *Trematodon ambiguus* (from Bry. Eur. *pl. 96*). 4, lower leaf; 5, upper leaves; 5*a*, 5*b*, leaf apex and base respectively showing cells; 7, perigonial leaf; 8, antheridium; 9, 10, perichaetial leaves; 12, very young capsule with calyptra; 17, dry and empty capsule; 18–22, peristome teeth; 23, exothecial cells and stomata; 24, spores.

PLATE 27. *A*. *Bryoxiphium norvegicum* (from The Plant World **1**: 2. 1897). 1, plants × 1 in normal habitat on stone; 2, three plants much enlarged, showing ♂ and ♀ plants and capsule; 3, two lower leaves; 4, two upper leaves; 5, 6, obtuse and acute leaf apices; 7, tapering serrate tip of leaf from apex of stem; 8, cells at base of leaf; 9, 10, cross sections of leaves; 11, mature capsule showing columella, attached operculum and calyptra; 12, operculum; 13, operculate capsule.

B. *Dicranella stikinensis* (drawings by Seville Flowers). 1, plants × 2; 2, portion of plant × 10; 3, upper and lower stem leaves × 20; 4, perichaetial leaves × 20; 5, apex of stem leaf × 20; 6, apex of inner perichaetial leaf × 20 (not all plants have leaves as blunt); 7, basal leaf cells × 200; 8, capsules × 13; 9, peristome teeth × 100, and portions of tooth × 400.



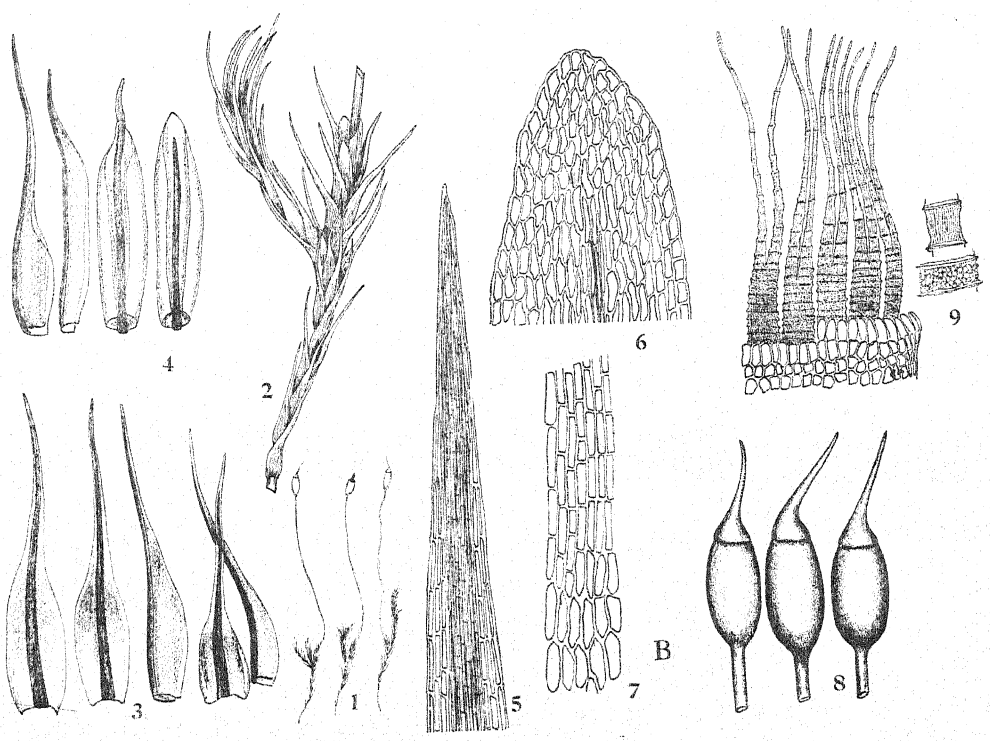
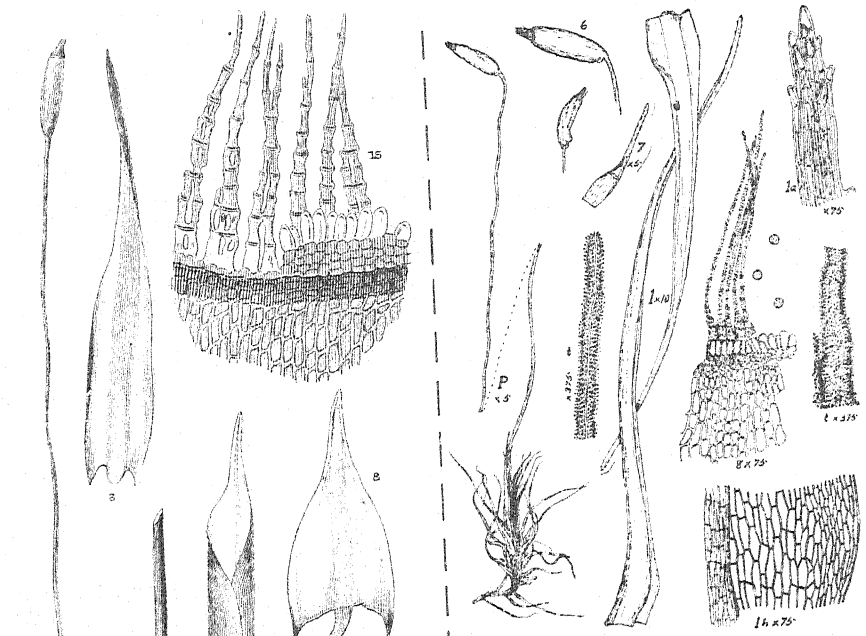
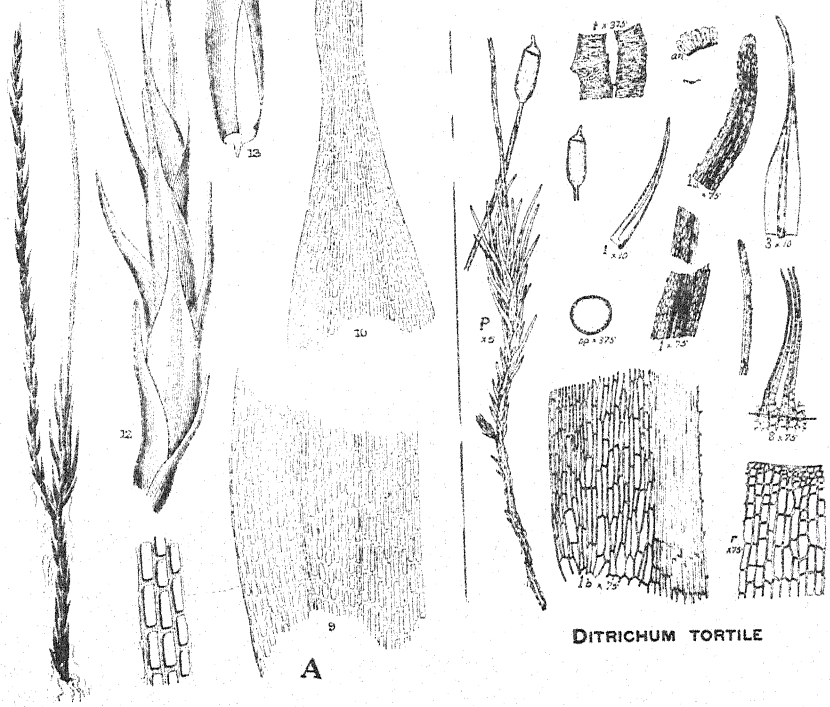


PLATE XXVII.



DITRICHUM PALLIDUM



DITRICHUM TORTILE

A

PLATE XXVIII.

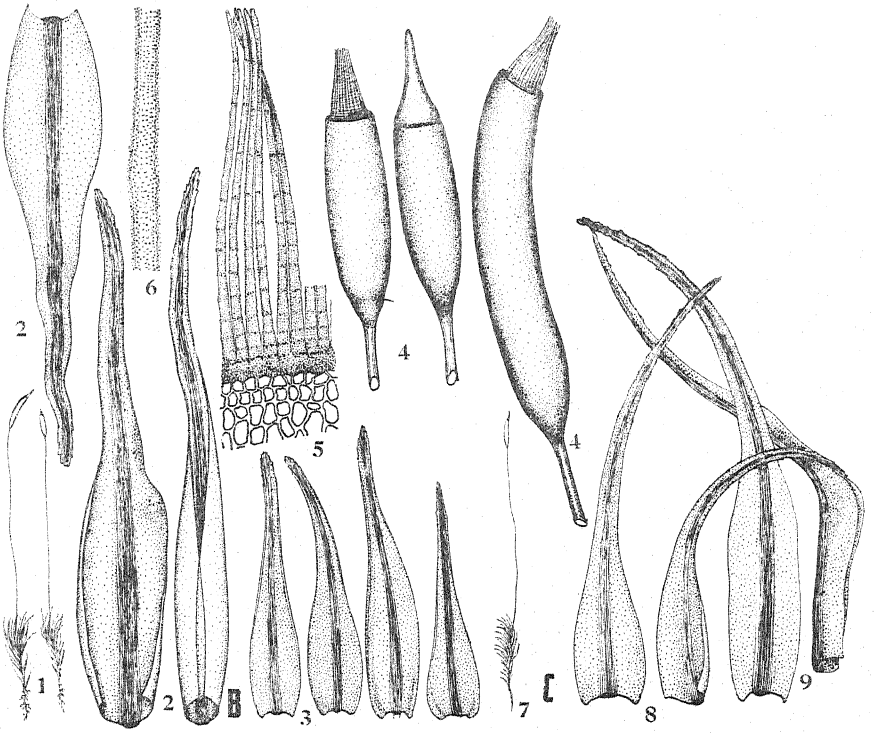
PLATE 28. *A*. *Ditrichum lineare* (from Sull. Icones Musc. *pl. 28*). 3, plant with innovation, enlarged; 6, leaf; 8, lower leaf; 9, 10, areolation of leaf base and apex respectively; 12, comal and perichaetial leaves at base of seta; 13, perichaetial leaf; 15, peristome teeth and a portion of the annulus.

Ditrichum pallidum and *D. pusillum* (*tortile*) (from Jennings, Mosses W. Pennsylvania, *pl. 6*). *P*, plant; 1, leaf; 1*a*, leaf apex; 1*b*, cells at leaf base; 3, perichaetial leaf; 6, capsule; 7, calyptra; 8, peristome; *t*, portion of peristome tooth.

PLATE 29. *A. Ditrichum flexicaule* and varieties. 1, stem leaves of *D. flexicaule* × 2; 2, perichaetial leaves × 20; 3, stem leaves of var. *densum* × 20; 4, leaves of var. *brevifolium* × 20; 5, basal leaf cells of *D. flexicaule* × 200; 6, basal and median leaf cells of var. *brevifolium* × 200; 7, 8, basal and median leaf cells of var. *densum* × 200; 9, peristome tooth of *D. flexicaule* × 100 and a portion of the same × 400.

B. Ditrichum ambiguum. 1, plants × 3; 2, upper stem leaves and perichaetial leaf × 20; 3, lower leaves × 20; 4, capsules × 20; 4^1 (right), capsule of Holzinger's Musc. Acro. Bor. Am. × 20; 5, peristome teeth × 100; 6, portion of tooth × 400.

C. Ditrichum tortuloides. 7, plant × 3; 8, stem leaves × 20; 9, perichaetial leaves × 20. (Drawings by Seville Flowers.)



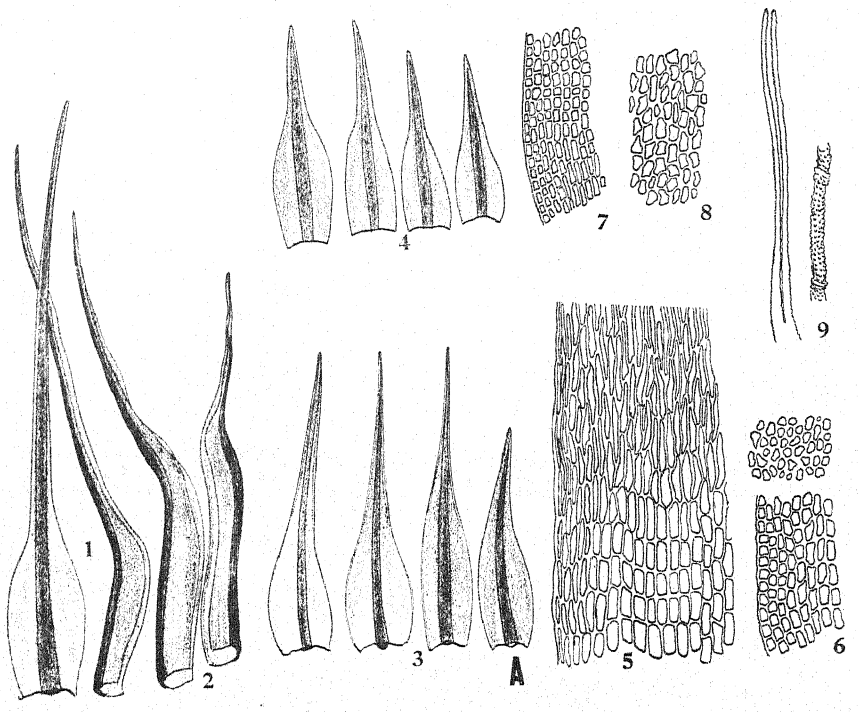


PLATE XXIX.

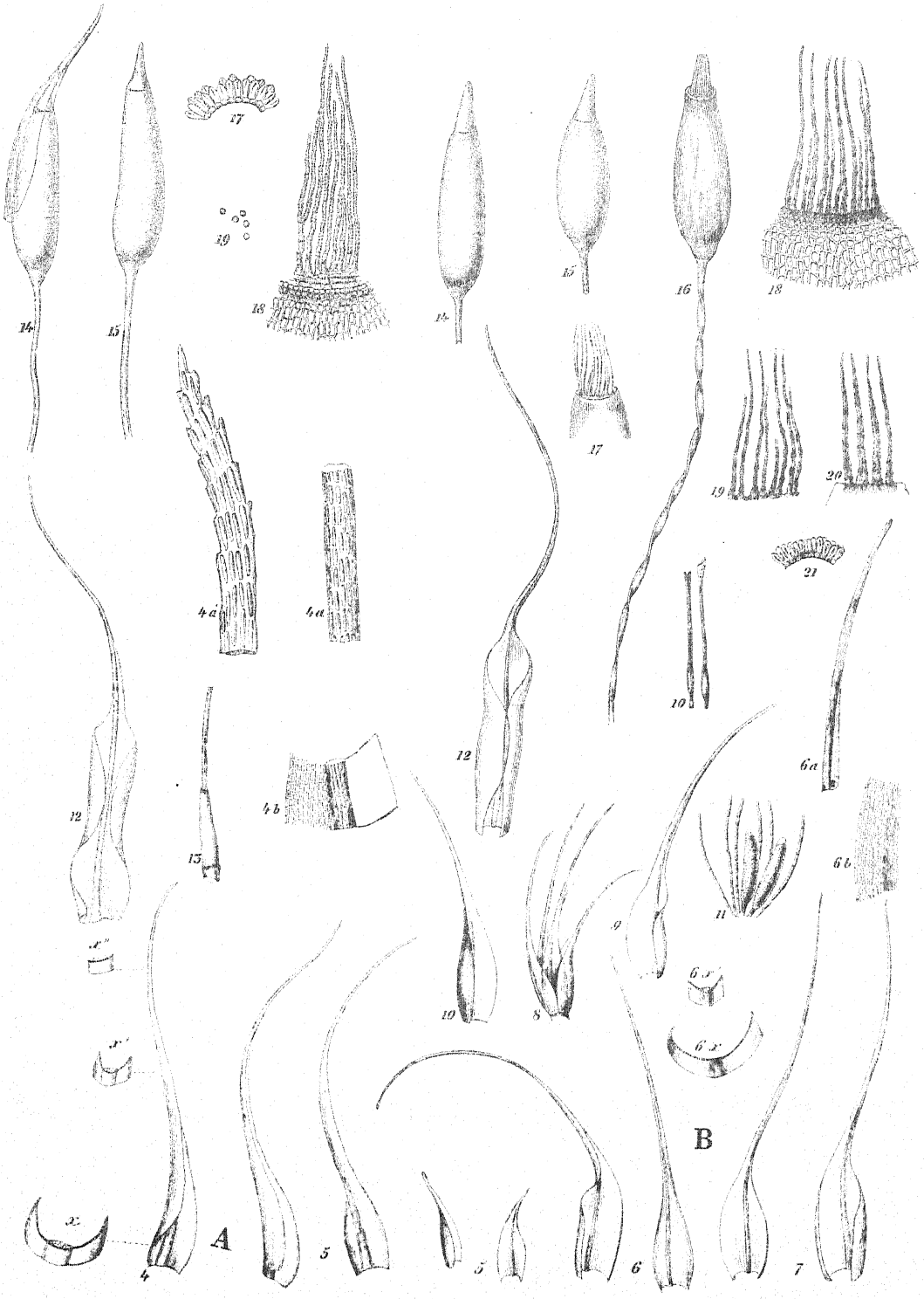


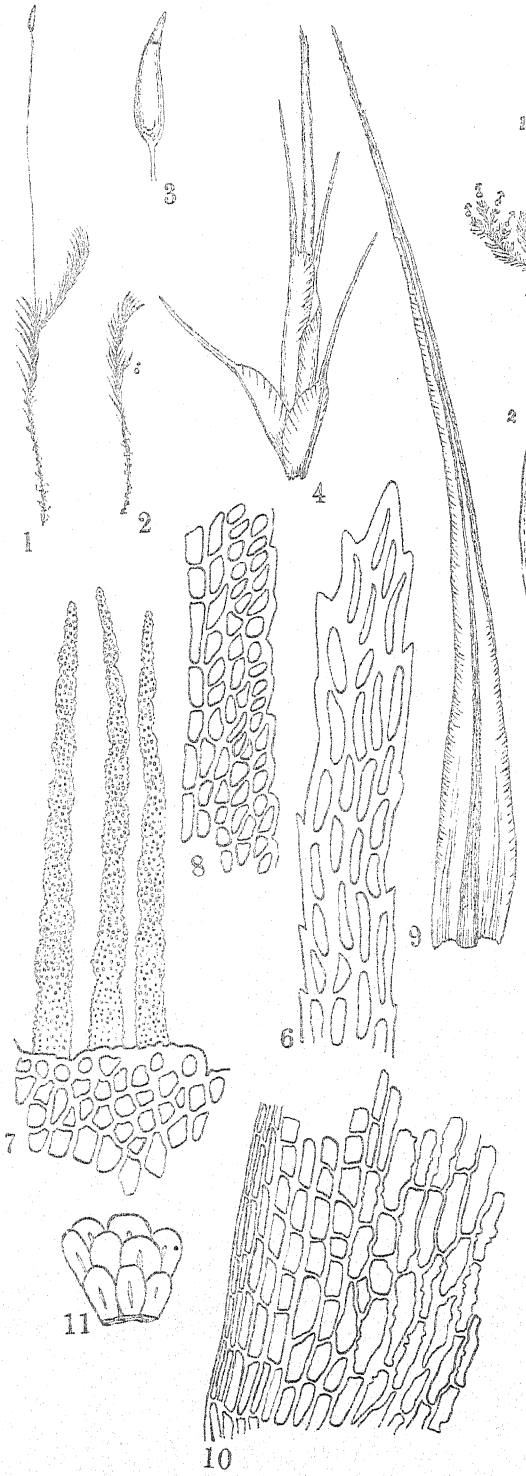
PLATE XXX.

PLATE 30. *A*. *Ditrichum flexicaule* (from Bry. Eur. *pl. 180*). 4, 5, leaves; 4*b*, cells of upper basal part of leaf; 4*a*, leaf apex; 12, perichaetial leaf; 13, vaginula and base of seta; 14, 15, capsules, 14 with calyptra; 17, annulus; 18, portion of peristome; 19, spores.

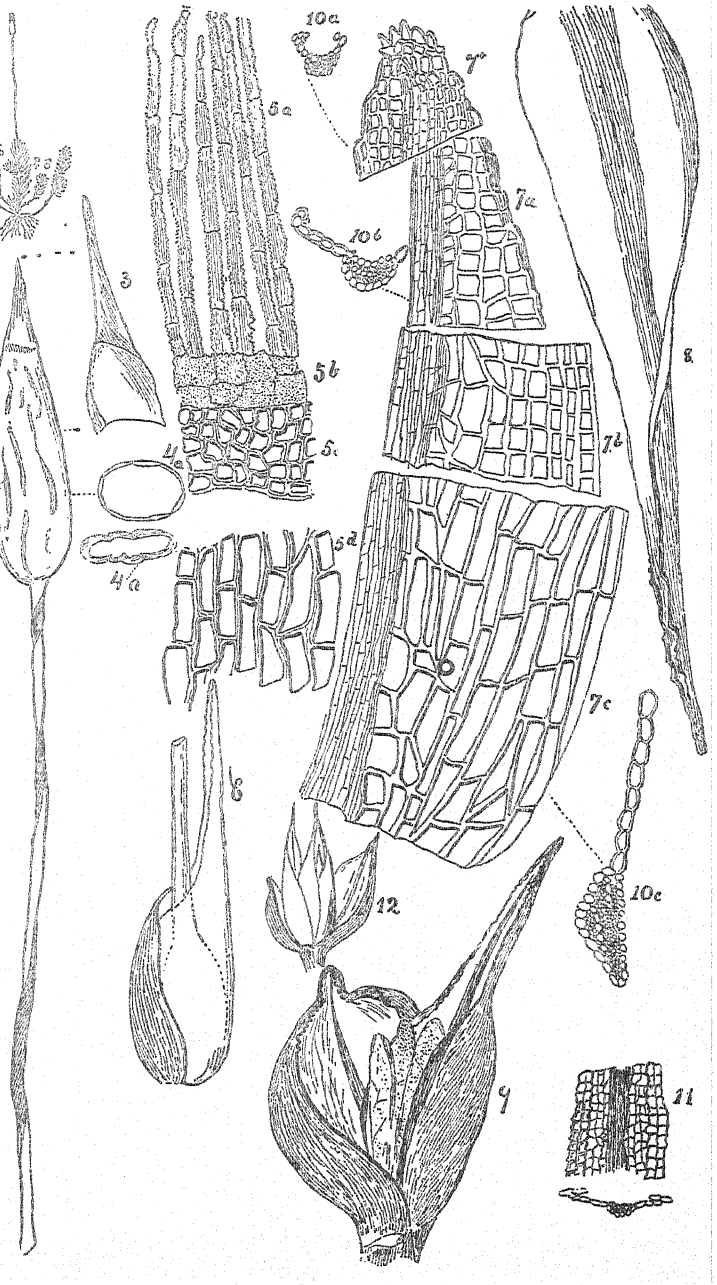
B. *Ditrichum heteromallum* (*D. homomallum*) (from Bry. Eur. *pl. 181*). 5, 6, 7, stem leaves; 6*x*, 6*x*^{1}, cross sections of 6; 6*a*, leaf apex; 6*b*, cells at leaf base; 8, 9, 10, 11, perigonial leaves and antheridia; 10, also archegonia; 12, perichaetial leaf; 14, 15, 16, capsules; 17–20, peristome; 21, annulus.

PLATE 31. *Ditrichum giganteum* (from Bull. N. Y. Bot. Gard. **2**: *pl. 15*). 1, 2, plants × 1; 3, capsule × 5; 4, perichaetium × 9; 6, apex of stem leaf × 285; 7, exothecial cells and part of peristome × 285; 8, marginal cells ½ down leaf × 285; 9, upper stem leaf × 12; 10, basal leaf cells × 285; 11, part of annulus × 285.

Ditrichum montanum (from Bull. Torr. Club. **20**: *pl. 143*). 1, plant × 1; 2, capsule enlarged; 3, calpytra; 4*a*, cross sections of capsule, upper fresh; lower, old and dry; 5*a*, 5*b*, 5*c*, peristome teeth, basilar membrane and exothecial cells; 5*d*, exothecial cells near capsule base; 7, leaf apex flattened; 10*a*, cross section of apex; 7*a*, 7*b*, 7*c*, apical, median and basal leaf cells respectively; 10*b*, 10*c*, cross sections as indicated; 8, stem leaf; 9, two perigonial leaves and antheridia; 11, fragment of leaf near apex, showing double row of marginal cells; 12, male bud; 6, sheathing perichaetial leaf.



DITRICHUM GIGANTEUM



DITRICHUM MONTANUM, LEIBERG.

LEPTOCERCUM SCHIMPERI.

PLATE XXXII.

PLATE 32. *Ditrichum Schimperi* (from Sull. Icones Musc. Suppl. *pl. 24*). 1, plants × 1; 2, plant enlarged; 3, stem and perichaetial leaves; 4, stem leaf; 5, sections of 4; 6, 7, cells of leaf apex and base; 8, part of stem with ♂ buds and base of seta; 9, capsules; 10, annulus and exothecial cells, peristome teeth and spores; 11, calyptra; 12–15, antheridial bud, perigonial leaves and antheridium with paraphysis.

PLATE 33. *A. Ditrichum cylindricum* (from Bry. Eur. *pl. 192*). 5–8, leaves; 7*a*, 7*b*, leaf apex and base; 9, 10, perigonial leaf and antheridium; 11, perichaetial and comal leaves; 12, 13, perichaetial leaves; 14, vaginula, base of seta and archegonium; 15, calyptra; 16–19, capsules; 20, operculum; 21, 23, 24, peristome; 22, annulus.

B. Ditrichum boreale (from Bryol. **14:** *pl. 2*). 1, operculate capsule; 2, peristome teeth; 3, marginal cells of operculum.

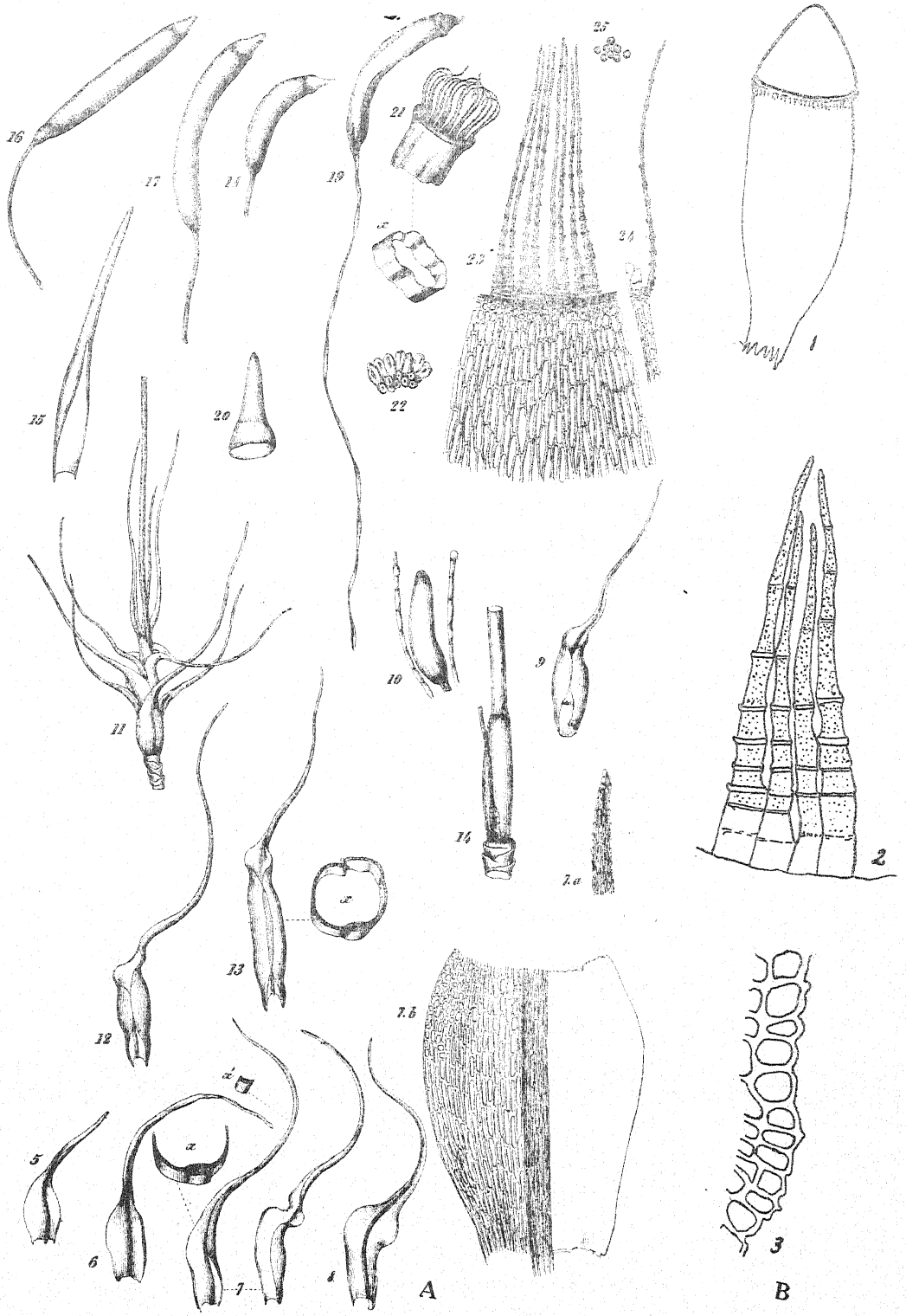
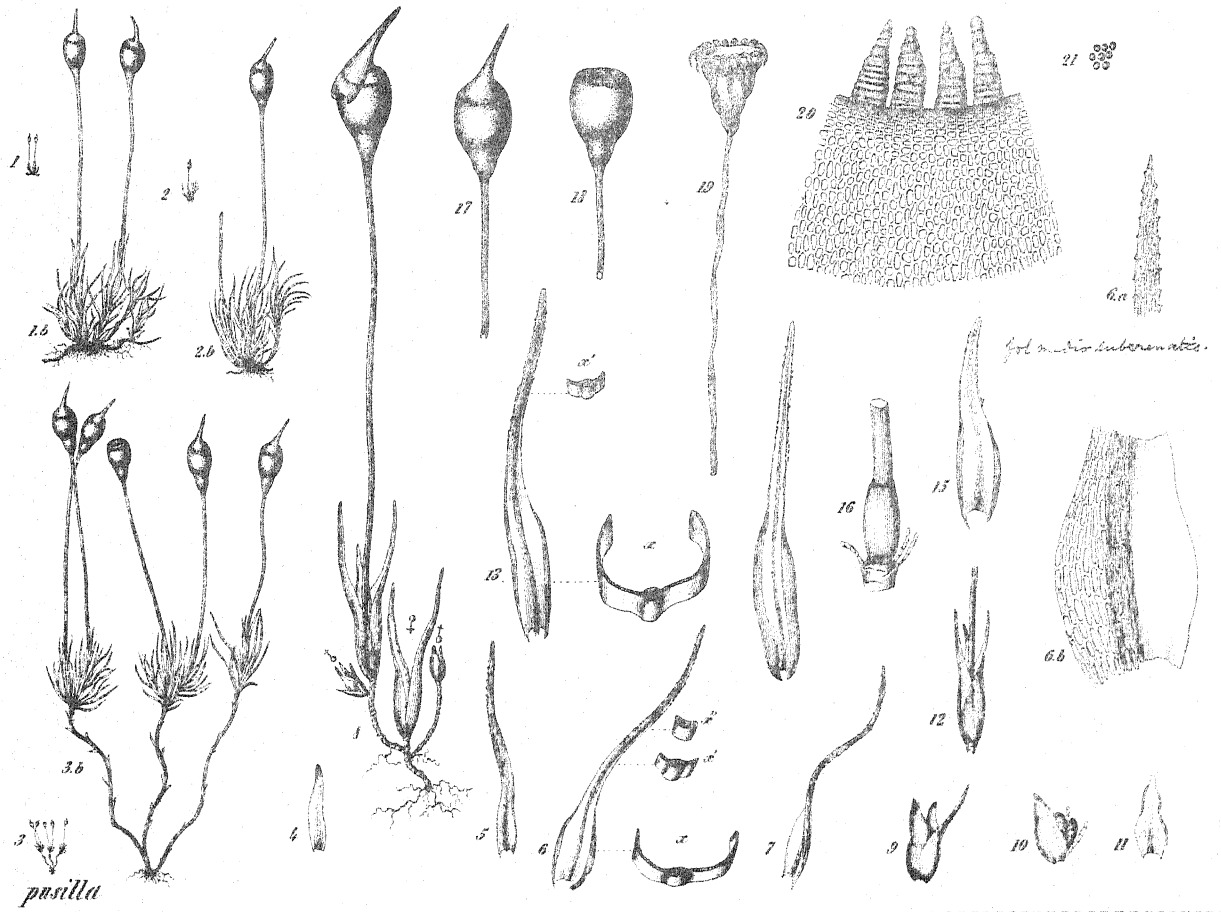


PLATE XXXIII.



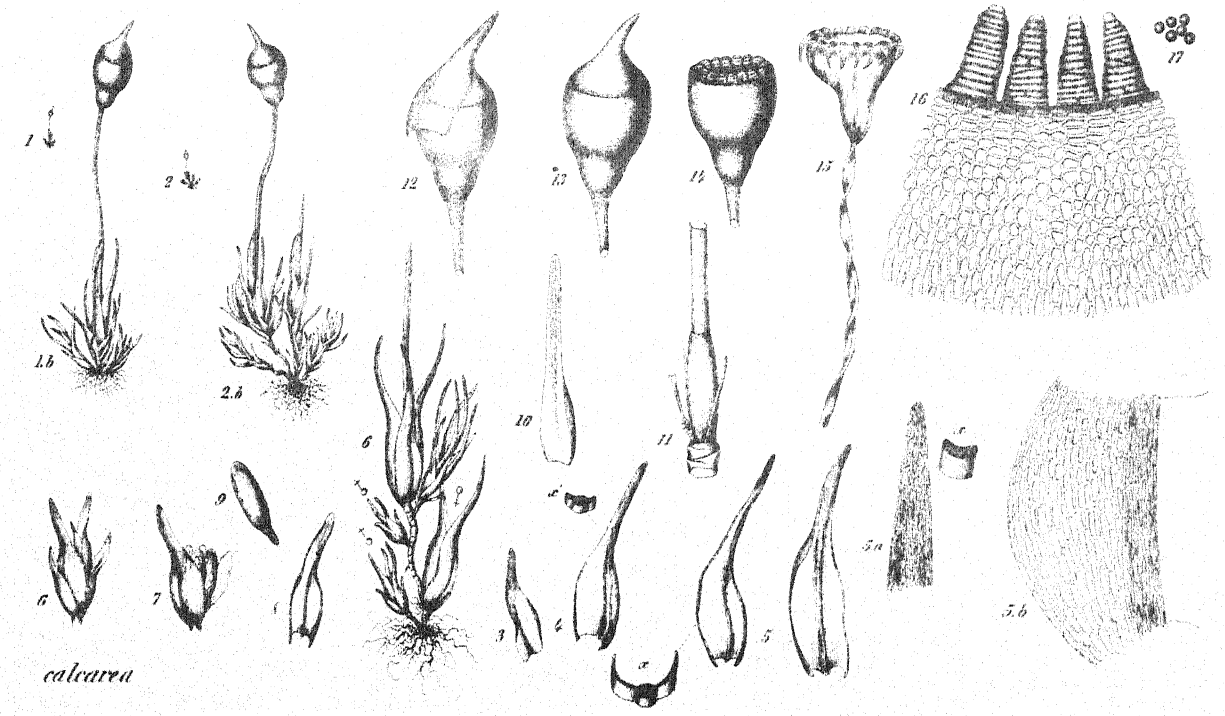


PLATE XXXIV.

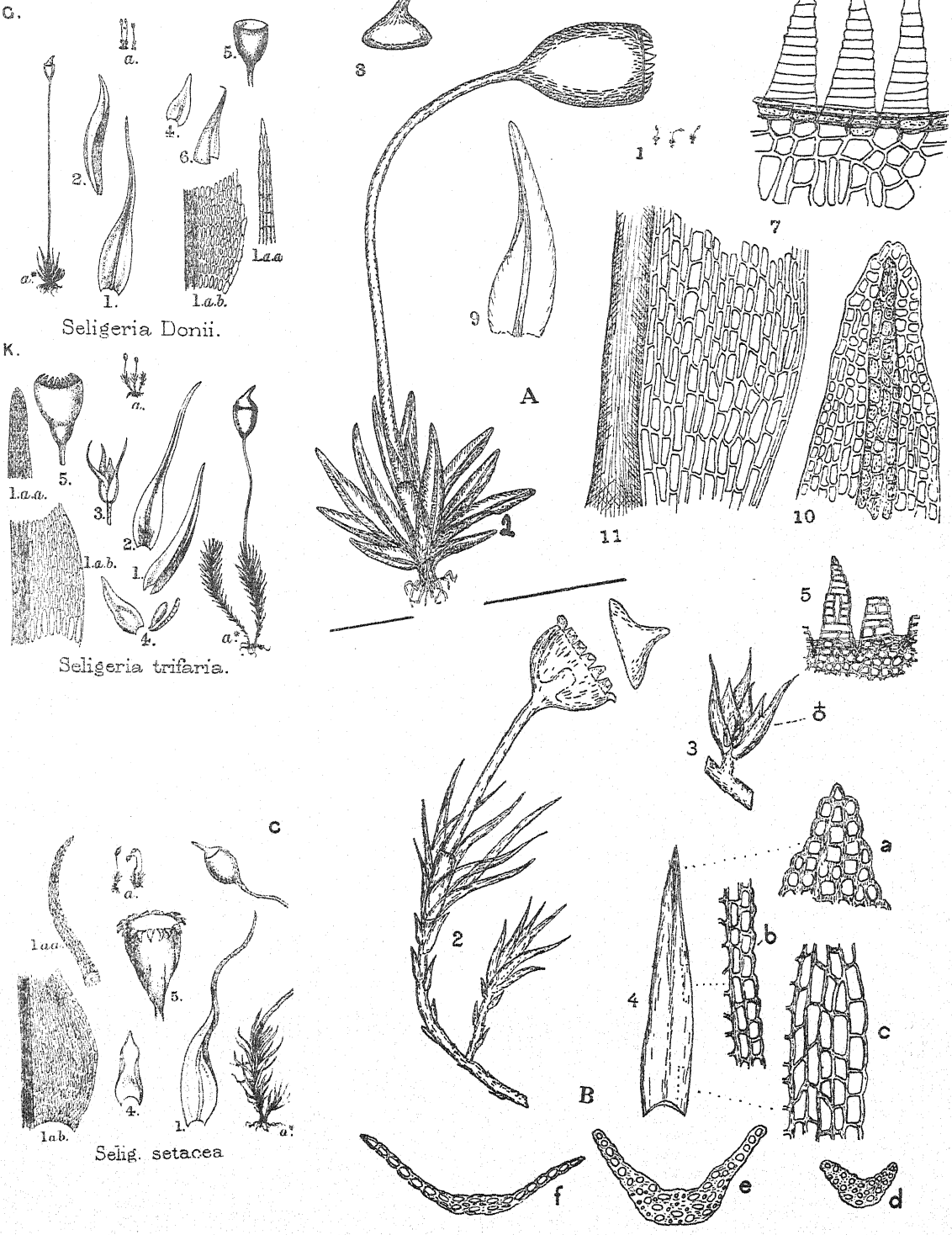
PLATE 34. *Seligeria pusilla* (from Bry. Eur. *pl. 110*). 1, 2, 3, plants × 1; 1*b*–3*b*, plants enlarged; 6*a*, 6*b*, cells of leaf apex and base respectively; 4–7, leaves; 8, base of plant stripped to show ♂ and ♀ buds; 9, 10, 11 male bud, perigonial leaves and antheridia; 12–15, perichaetial leaves; 16, vaginula and base of seta; 17–19, capsules; 20, ¼ mouth of capsule and 4 peristome teeth; 21, spores.

S. calcarea (from Bry. Eur. l. c.). 1, 2, plants; 1*b*, 2*b*, plants enlarged; 3–5, stem leaves; 5*a*, 5*b*, cells of leaf apex and base respectively; base of plant stripped to show ♂ and ♀ buds; 6–8, ♂ bud, perigonial leaves and antheridia; 9, antheridium; 10, perichaetial leaf; 12–15, capsules; 16, portion of capsule mouth with peristome teeth; 17, spores.

PLATE 35. *Seligeria Doniana*, *S. trifaria*, and *S. recurvata* (*setacea*) (from Braithw. Brit. Moss Fl. **1**: *plates 16* and *17*). Description as for *plate 18A–F*.

A. *Seligeria campylopoda* (from Bull. N. Y. Bot. Gard. **2**: *pl. 35*). 1, plants × 1; 2, plant enlarged; 3, operculum; 9, leaf; 10, 11, cells of leaf apex and base respectively; 7, peristome teeth and upper exothecial cells.

B. *Seligeria tristichoides* (from Bryol. **5**: 8. *figs. 2–5*). 2, plant much enlarged; 3, ♂ bud, 4, leaf with cells as indicated in *a–c*; *d–f*, cross sections of leaf, basal, median and apical; 5, portion of peristome.


C.
a.
5.
2.
4.
6.
a*
1.
1.a.b.
1.a.a
Seligeria Donii.
K.
a.
1.a.a.
5.
3.
2.
1.
1.a.b.
4.
a*
Seligeria trifaria.
c
a.
1.a.a
5.
1.a.b.
4.
1.
a*
Selig. setacea
3
1
9
A
2
7
11
10
5
3
a
2
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c
B
f
e
d

PLATE XXXV.

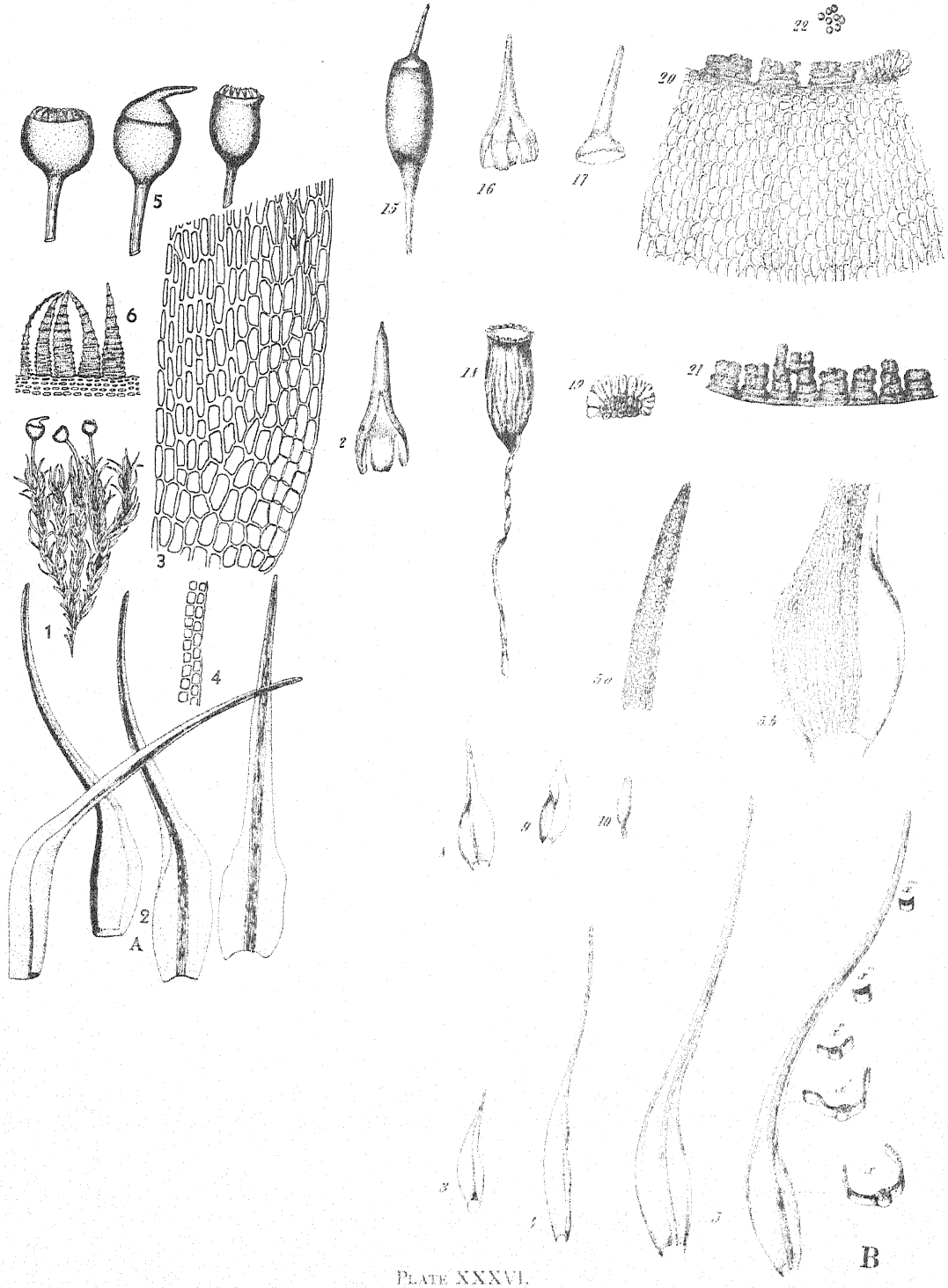


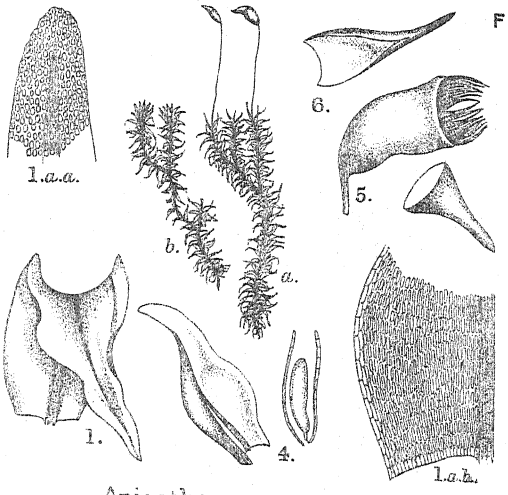
PLATE XXXVI.

PLATE 36. *A*. *Seligeria polaris*. 1, plant × 3; 2, leaves × 20; 3, basal cells × 200; 4, upper marginal cells × 200; 5, capsules × 13; 6, peristome teeth × 50 (drawings by Seville Flowers from specimens from arctic America).

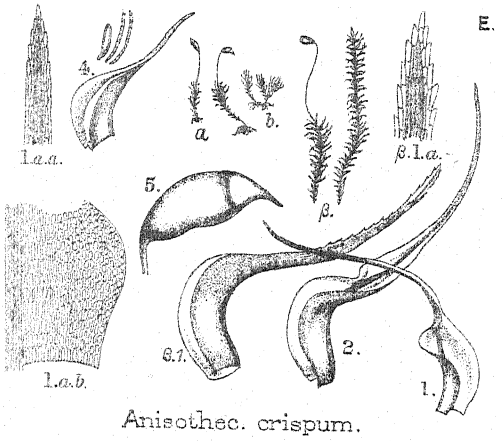
B. *Brachydontium trichodes* (from Bry. Eur. *pl. 115*). 3–5, leaves; 5*a*, 5*b*, areolation of leaf apex and base respectively; 8, 9, perigonial leaves; 10, antheridium; 12, 16, calyptrae; 15, fresh operculate capsule; 18, old dry capsule; 17, operculum; 19, annulus; 20, exothecial cells, portion of peristome and annulus; 21, peristome teeth; 22, spores.

PLATE 37. *Dicranella squarrosa*, *D. Grevilleana* (as *Anisothecium*), and *D. Schreberi* (as *Anisothecium crispum*) (from Braithw. Brit. Moss Fl. **1**: *pl. 16, figs. F, E, D, respectively*). *Dicranella crispa* and *D. subulata* (as *D. secunda*) (from Braithw. l. c. *pl. 15, figs. D, E*, respectively). Description as for *Pl. 18A–F.*

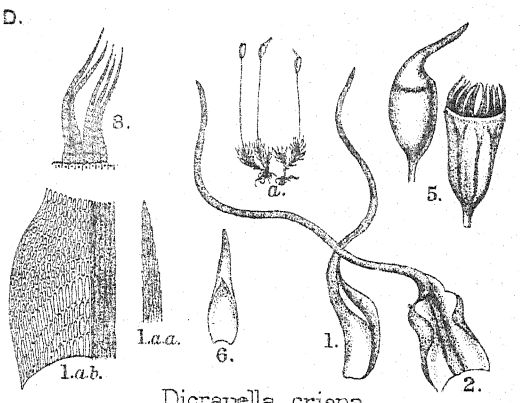
A. *Dicranella Herminieri* (from Bot. Gaz. **19**: *pl. 21A*, as *D. leptotrichoides*). *a*, plants; *b*, *b*, leaves; *c*, cells of basal leaf border; *e*, *f*, capsules; *g*, portion of annulus; *h*, two peristome teeth.



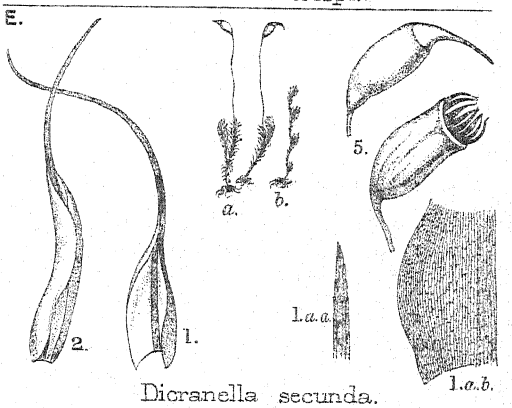
Anisothec. squarrosum.



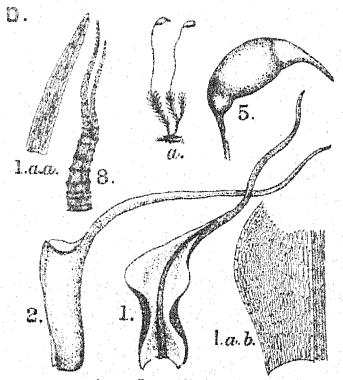
Anisothec. crispum.



Dicranella crispa.



Dicranella secunda.



Anisoth. Grevillei.

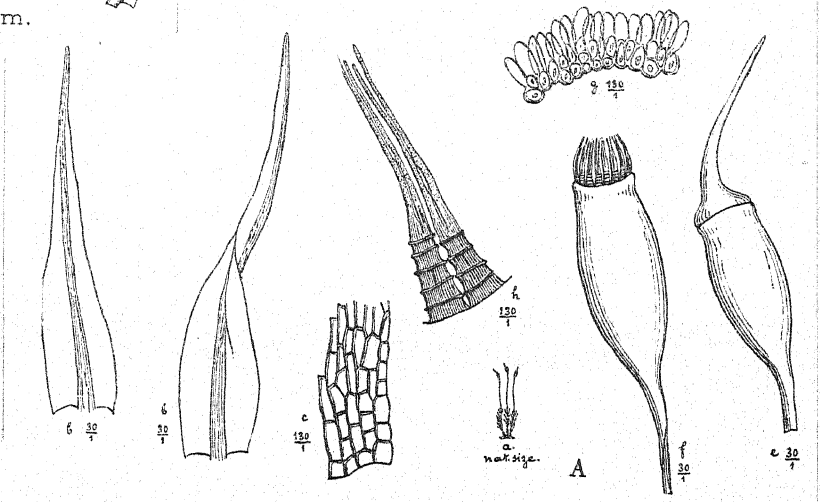


PLATE XXXVII.

DICRANUM DEBILE, Hook et Wils.

PLATE XXXVIII.

PLATE 38. *Dicranella Hilariana* (from Sull. Icones Musc. *pl. 20*, as *D. debile*). 1, plants × 1; 2, 3, ♀ and ♂ plants; 4–8, leaves; 9, 10, cells of leaf base and apex respectively; 11, cross sections of leaves; 12, 13, capsules; 14, part of the peristome with spores; 15, longitudinal section of the same; 16, operculum; 17, 18, perigonial leaf and antheridium.